CHAPTER

32

Landing Gear

CHAPTER 32
LANDING GEAR

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LANDING GEAR - INTRODUCTION

Purpose

The landing gear provides support for the airplane static and ground maneuvering conditions. The landing gear also reacts to airplane load forces that are generated during airplane movement.

These are the landing gear systems:

- The main landing gear (MLG) and doors (32-10)
- The nose landing gear (NLG) and doors (32-20).

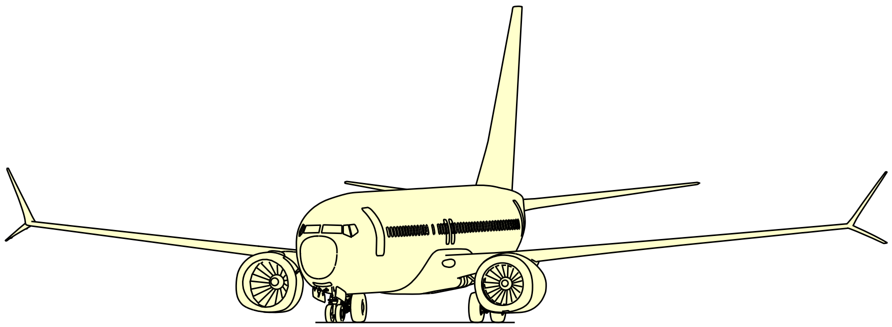
The landing gear extension and retraction systems extend and retract the landing gear (32-30).

The nose wheel steering system supplies the ground directional control of the airplane (32-50).

Abbreviations and Acronyms

- AACU - antiskid/autobrake control unit
- A/B - autobrake
- AC - alternating current
- accum - accumulator
- ADIRU - air data inertial reference unit
- alt - alternate
- bat - battery
- BITE - built-in-test-equipment
- BMS - Boeing material specification
- BMV - brake metering valve
- DC - direct current
- ext - extend
- flt dk - flight deck
- GRD - ground
- gpm - gallons per minute
- hyd - hydraulic
- inbd - inboard
- inop - inoperative
- LG - landing gear
- lpm - liters per minute
- MLG - main landing gear
- max - maximum
- NLG - nose landing gear
- norm - normal
- NWS - nose wheel steering
- outbd - outboard
- P - pressure
- pri - primary
- PSEU - proximity switch electronics unit
- PSI - pounds per square inch
- qty - quantity
- RTO - rejected takeoff
- sec - secondary
- sol - solenoid
- sw - switch
- sys - system
- vlv - valve
- ww - wheel well
- xfr - transfer
- xmtr - transmitter

LANDING GEAR - INTRODUCTION



- LANDING GEAR
  - MAIN LANDING GEAR AND DOORS
  - NOSE LANDING GEAR AND DOORS
  - EXTENSION AND RETRACTION
  - NOSE WHEEL STEERING
  - TAIL SKID

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LANDING GEAR - INTRODUCTION

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LANDING GEAR - GENERAL DESCRIPTION

General

The 737 airplane has a tricycle type landing gear with air/oil shock struts.

These are the landing gear structural systems:

- The main landing gear (MLG) and doors (32-10)
- The nose landing gear (NLG) and doors (32-20)

The landing gear extension and retraction systems extend and retract the main and nose landing gear (32-30).

The nose wheel steering system supplies the ground directional control of the airplane (32-50).

Components

The components for the main and nose landing gear systems are in these locations:

- Flight compartment
- Forward equipment compartment
- Nose landing gear wheel well
- Main landing gear wheel well

The components for the nose wheel steering system are in these locations:

- Flight compartment
- Forward equipment compartment
- Nose landing gear wheel well

Landing Gear System

These are the components of the landing gear system in the flight compartment:

- Landing gear control lever assembly
- Manual extension control handles
- Landing gear position lights
- Auxiliary landing gear position lights
- Landing gear panel

These are the components of the landing gear system in the forward equipment compartment:

- Proximity switch electronics unit (PSEU)

These are the components of the landing gear system in the nose landing gear wheel well:

- Nose landing gear
- Nose landing gear actuator
- Lock mechanism and lock actuator
- Valve manifold
- Transfer cylinder

These are the components of the landing gear system in the main landing gear wheel well:

- Transfer valve
- Selector valve
- Shimmy damper
- Main landing gear (2)
- Main landing gear actuator (2)
- Uplock mechanism and actuator (2)
- Downlock mechanism and actuator (2)
- Transfer cylinder (2)
- Frangible fitting (2)

The locations of the components for the nose wheel steering system are given in 32-51-00-002.

General Description

Hydraulic system A normally supplies pressure to the landing gear extension and retraction. Hydraulic system B supplies pressure for retraction only.

LANDING GEAR - GENERAL DESCRIPTION

The landing gear transfer valve receives electrical signals from the proximity switch electronics unit (PSEU). The landing gear transfer valve changes the pressure source of the landing gear from hydraulic system A to hydraulic system B.

See the Air/Ground System section for more information about the proximity switch electronics unit (PSEU) (SECTION 32-09).

You move the landing gear control lever assembly to control landing gear extension and retraction. The control lever module sends an electrical signal to the selector valve.

The selector valve also gets an electrical input from the manual extension system. This operates a bypass valve in the selector valve to connect the landing gear retraction to the hydraulic system return. This lets the manual extension system extend the landing gear.

Landing gear lights show the position of the landing gear. The PSEU receives landing position signals from sensors on the landing gear. The normal and auxiliary lights are controlled by the PSEU.

The pressure for nose wheel steering comes from the nose landing gear extension pressure only. Hydraulic system A normally supplies pressure to the nose gear steering through the landing gear control system.

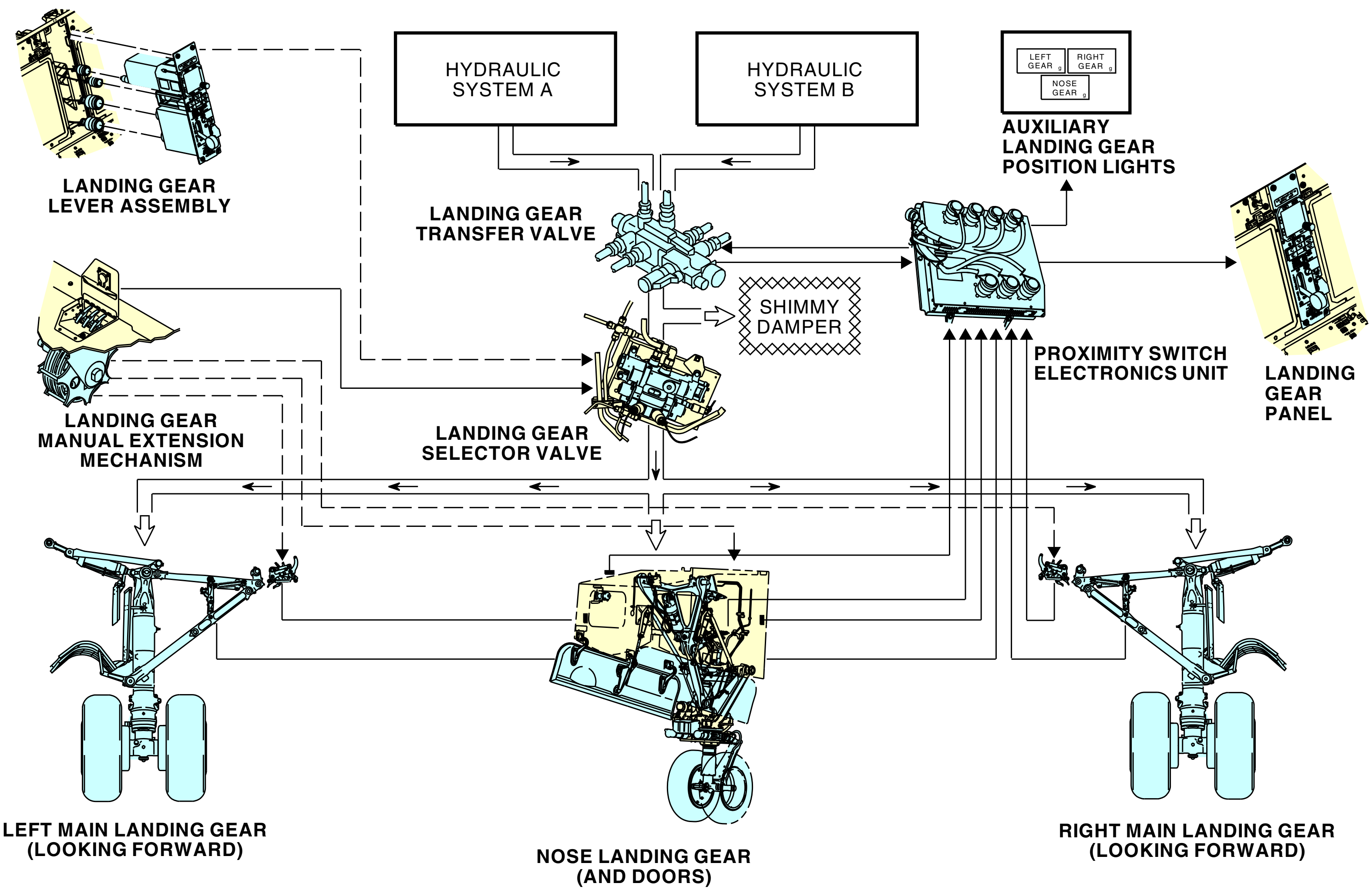
See the nose wheel steering system for more information about the nose wheel steering (SECTION 32-51).

The landing gear control system also provides normal or alternate hydraulic pressure to these systems:

- Main landing gear shimmy damper
- Gear retract brake system

See the Main Landing Gear and Doors System for more information about the main landing gear shimmy damper (SECTION 32-10).

LANDING GEAR - GENERAL DESCRIPTION



LANDING GEAR - GENERAL DESCRIPTION

LANDING GEAR - DOWNLOCK PIN - MAIN LANDING GEAR

General

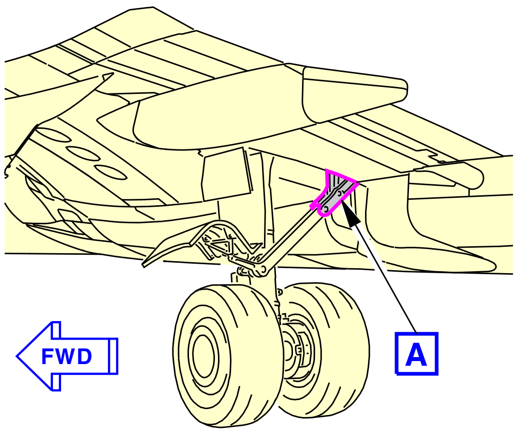
You install a downlock pin into the main landing gear to make sure an outside force does not unlock the main landing gear.

There is one main landing gear downlock pin for each main landing gear.

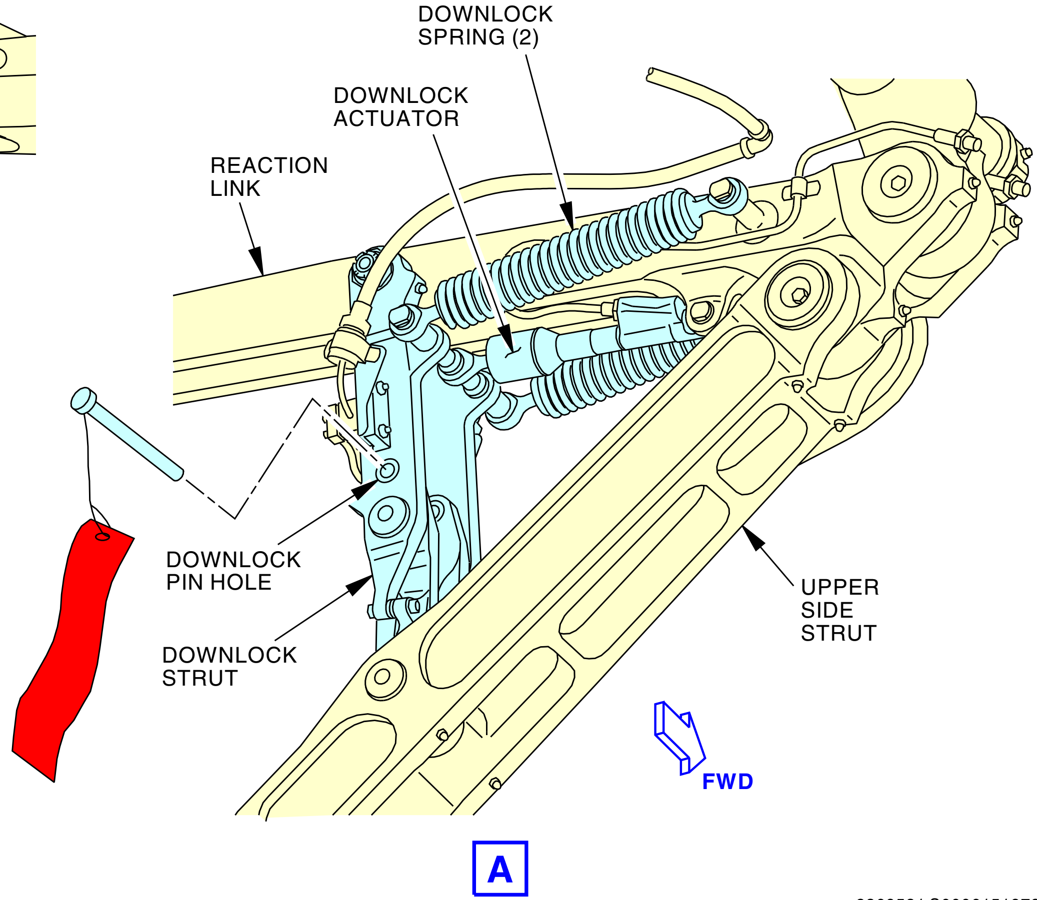
The downlock pin installs in the MLG downlock strut.

WARNING	YOU MUST CAREFULLY INSTALL THE GROUND LOCKS IN ALL LANDING GEAR. AN ACCIDENTAL RETRACTION OF THE LANDING GEAR CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

LANDING GEAR - DOWNLOCK PIN - MAIN LANDING GEAR



LEFT MAIN LANDING GEAR



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LANDING GEAR - DOWNLOCK PIN - MAIN LANDING GEAR

LANDING GEAR - DOWNLOCK PIN - NOSE LANDING GEAR

General

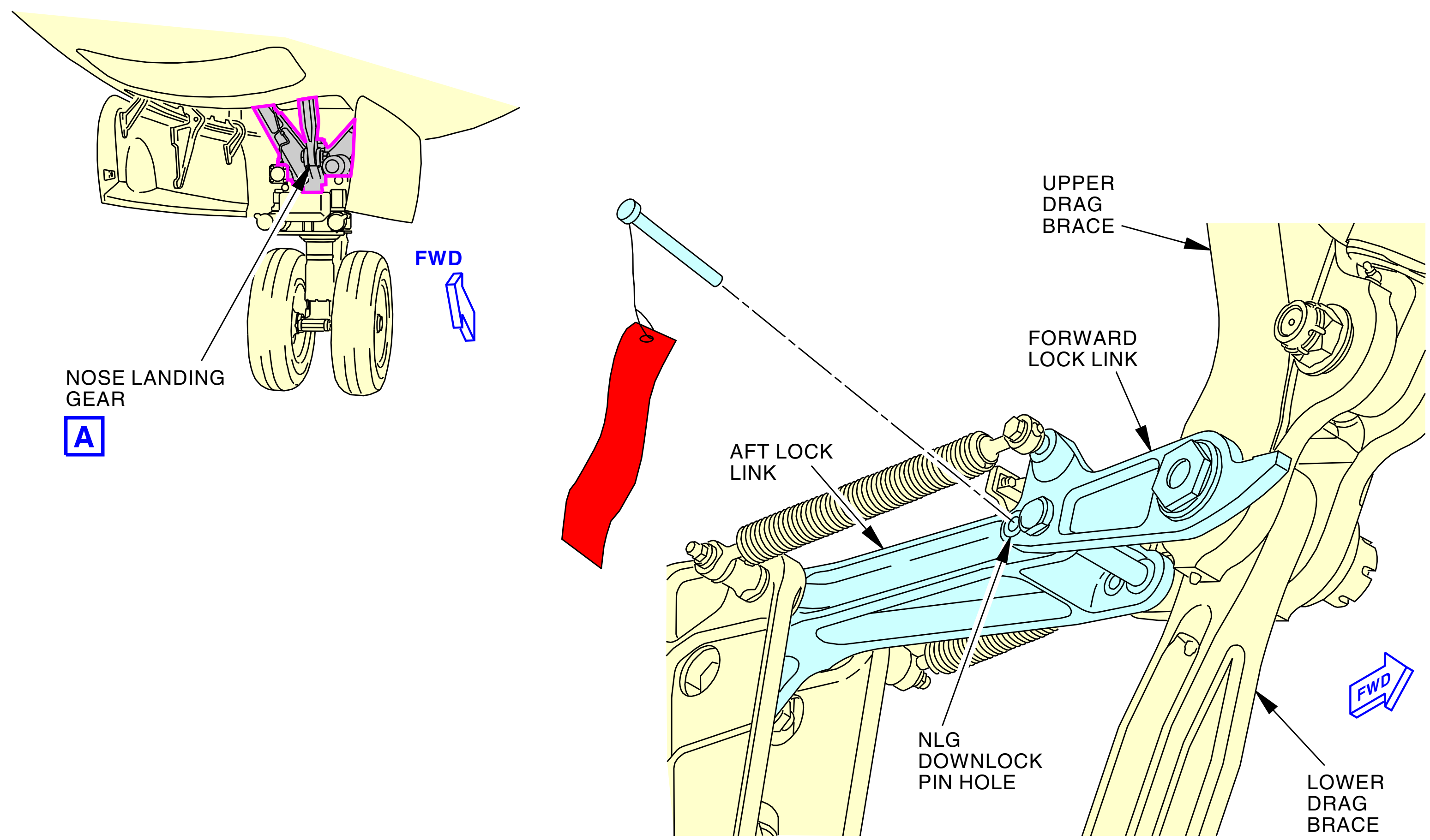
You install a downlock pin into the nose landing gear to make sure an outside force does not unlock the nose landing gear.

There is one nose landing gear downlock pin for the nose landing gear.

The nose landing gear downlock pin installs in the NLG downlock pin hole.

WARNING YOU MUST CAREFULLY INSTALL THE GROUND LOCKS IN ALL LANDING GEAR. AN ACCIDENTAL RETRACTION OF THE LANDING GEAR CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

LANDING GEAR - DOWNLOCK PIN - NOSE LANDING GEAR



NOSE LANDING GEAR LOCKING MECHANISM

A

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LANDING GEAR - DOWNLOCK PIN - NOSE LANDING GEAR

AIR/GROUND SYSTEM - INTRODUCTION

Purpose

The air/ground system supplies air/ground discrete signals to many airplane systems.

The proximity switch electronics unit (PSEU) is a component of the air/ground system. Many airplane systems send signals to the PSEU through position sensors and switches. The PSEU also controls the air/ground relays (12).

These are the systems/components controlled by the proximity switch electronics unit (PSEU):

- Landing gear transfer valve
- Landing gear position indicating and warning
- Landing gear selector valve (retract only)
- Two-position tail skid
- Takeoff warning
- Door warning
- Air/ground relays.

General

The landing gear transfer valve lets the landing gear be raised by the B hydraulic system. See the landing gear control system section for more information about the landing gear transfer valve.

Landing gear position indication and warning provides indication about the status of the landing gear. It also warns the pilot of an unsafe condition. See the landing gear position indication and warning system section for more information about landing gear position indication and warning.

The landing gear selector valve directs hydraulic pressure from the transfer valve to extend and retract the main landing gear and the nose landing gear.

The two-position tail skid will extend when the airplane is in the approach to landing configuration and will retract for on-ground, take off, and cruise configurations.

The takeoff warning system turns on the aural warning horn for an unsafe airplane configuration before takeoff (on ground) or after takeoff (in air). See the takeoff warning system section for more information about the takeoff warning system.

The door warning system provides indication about the status of the airplane doors. See the door warning system section for more information about the door warning.

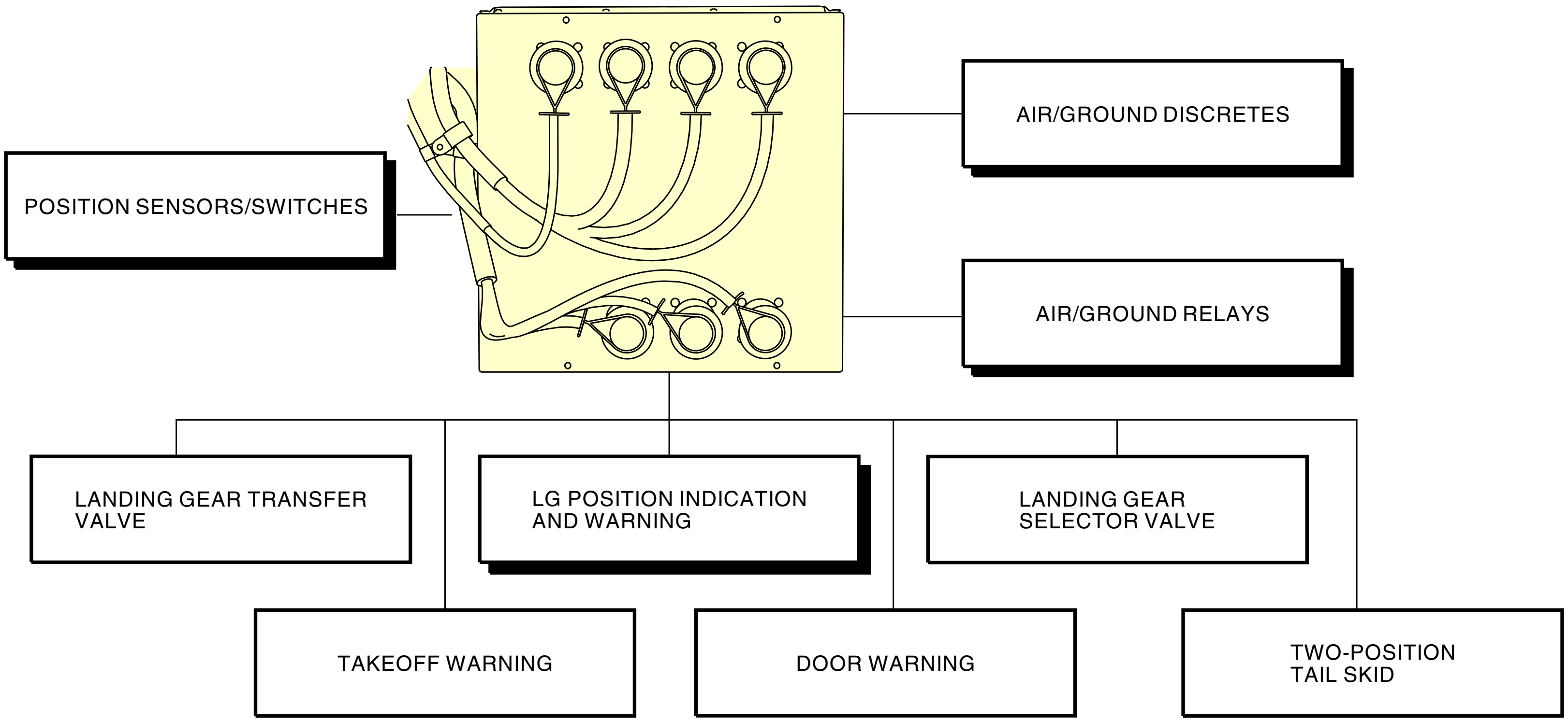
Abbreviations and Acronyms

- AACU - antiskid/autobrake control unit
- ACARS - aircraft communications addressing and reporting system
- ACP - attendant control panel
- ADF - automatic direction finder
- ADIRU - air data inertial reference unit
- altn - alternate
- APU - auxiliary power unit
- ATC - air traffic control
- bat - battery
- BITE - built-in test equipment
- BPCU - bus power control unit
- CB - circuit breaker
- config - configuration
- DC - direct current
- DFCS - digital flight control system
- DME - distance measuring equipment
- DPC - digital processing computer
- DFDAU - digital flight data acquisition unit
- ECU - electronic control unit
- FDRS - flight data recording system
- FMCS - flight management computer system
- FPGA - field programmable gate unit

AIR/GROUND SYSTEM - INTRODUCTION

- FSEU - flap/slat electronics unit
- fwd - forward
- GCU - generator control unit
- gnd - ground
- GRD - ground
- GPWS - ground proximity warning system
- I/O - input/output
- L - left
- IGS - Inert Gas System
- LG - landing gear
- LGTV - landing gear transfer valve
- ILS - instrument landing system
- LRU - line replaceable unit
- MDS - max display system
- MLG - main landing gear
- NLG - nose landing gear
- NWS - nose wheel steering
- OMS - onboard maintenance system
- pri - primary
- PSEU - proximity switch electronics unit
- SCE - spoiler control electronics
- sec - secondary
- R - right
- RA - radio altimeter
- REF - reference
- SMYD - stall management yaw damper
- sys - system
- sw - switch
- TCAS - traffic collision avoidance system
- TE - trailing edge
- T/O - takeoff
- V - volt
- VHF - very high frequency
- VOR - VHF omnidirectional ranging
- WW - wheel well
- WX - weather radar

AIR/GROUND SYSTEM - INTRODUCTION



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AIR/GROUND SYSTEM - INTRODUCTION

AIR/GROUND SYSTEM - GENERAL DESCRIPTION

Purpose

The air/ground system supplies air mode and ground mode signals to airplane systems.

Components

These are the air/ground system components:

- Nose landing gear compressed sensors
- Left main landing gear compressed sensors
- Right main landing gear compressed sensors
- Proximity switch electronics unit (PSEU)
- Air/ground relays
- MAINT fault light.

General Description

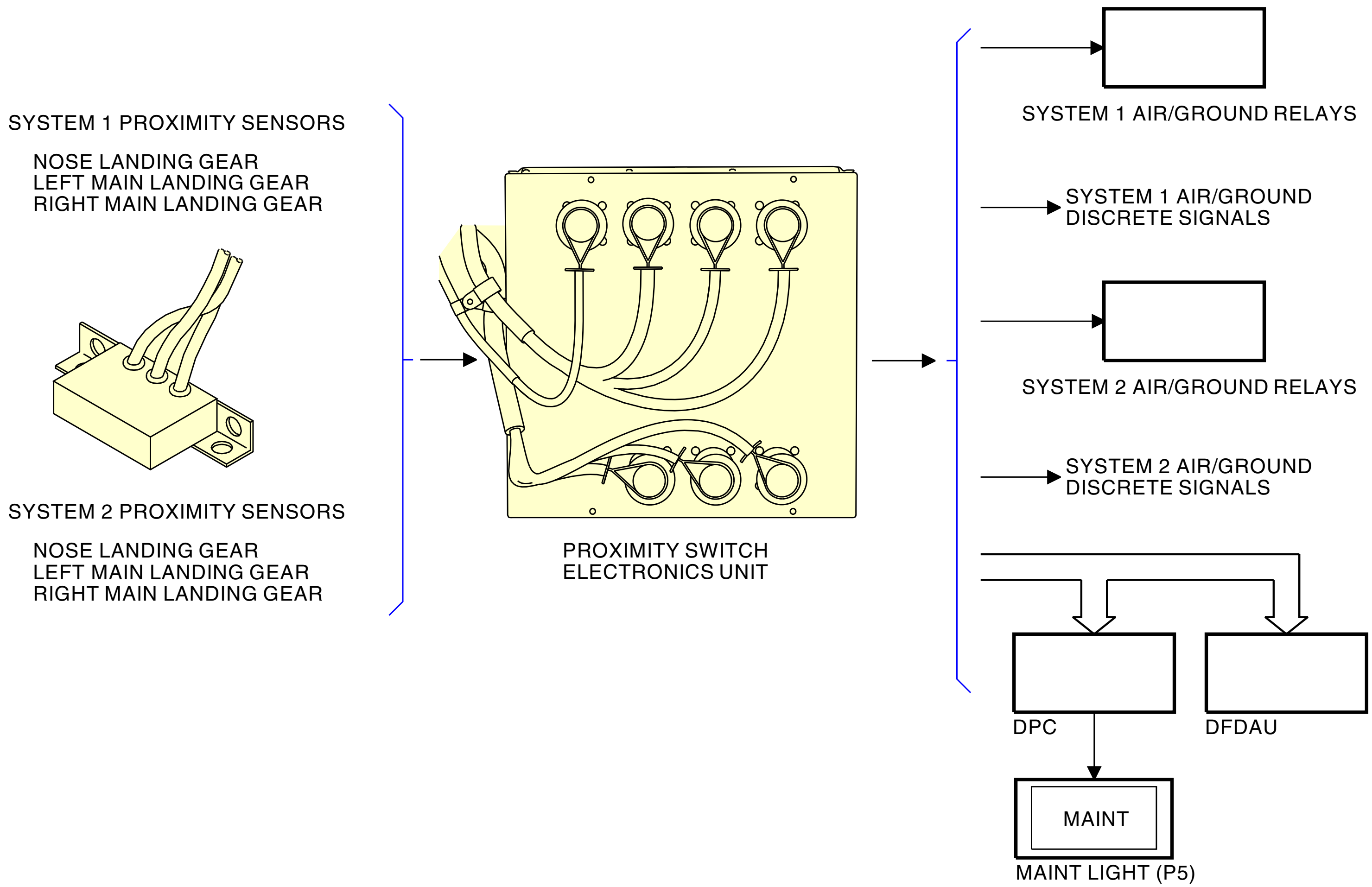
Two air/ground systems monitor the compression of the landing gear shock struts.

Two compressed sensors are on each landing gear. One sensor sends inputs to air/ground system 1 and the other sensor sends inputs to air/ground system 2.

Sensor signals go to the PSEU. The two air/ground systems in the PSEU monitor signals from the sensors in their air/ground system. The PSEU then sends air/ground discrete signals and signals to operate air/ground relays. Airplane systems use the air/ground discrete signals and relays for airplane air/ground inputs.

The amber MAINT light comes on when either air/ground system is in override mode. The light is also used for fault indication.

AIR/GROUND SYSTEM - GENERAL DESCRIPTION



AIR/GROUND SYSTEM - GENERAL DESCRIPTION

AIR/GROUND SYSTEM - MAIN LANDING GEAR PROXIMITY SENSORS

Purpose

Two main landing gear proximity sensors on each main landing gear supply main landing gear shock strut compressed position signals to the air/ground system.

Physical Description

The landing gear proximity sensors are inductance type sensors. Each sensor has a metal target and a sensor.

Location

The main landing gear proximity sensors are on the lower area of the outer cylinder of the main landing gear. The targets are on each side of the upper torsion link where the link attaches to the outer cylinder of the main landing gear.

The sensor identification placards on the sensor bracket show the sensor number. These are the main landing gear proximity sensor numbers:

Sensor Number	MLG	Location
S1010	Right	Outboard
S1011	Right	Inboard
S1012	Left	Outboard
S1013	Left	Inboard

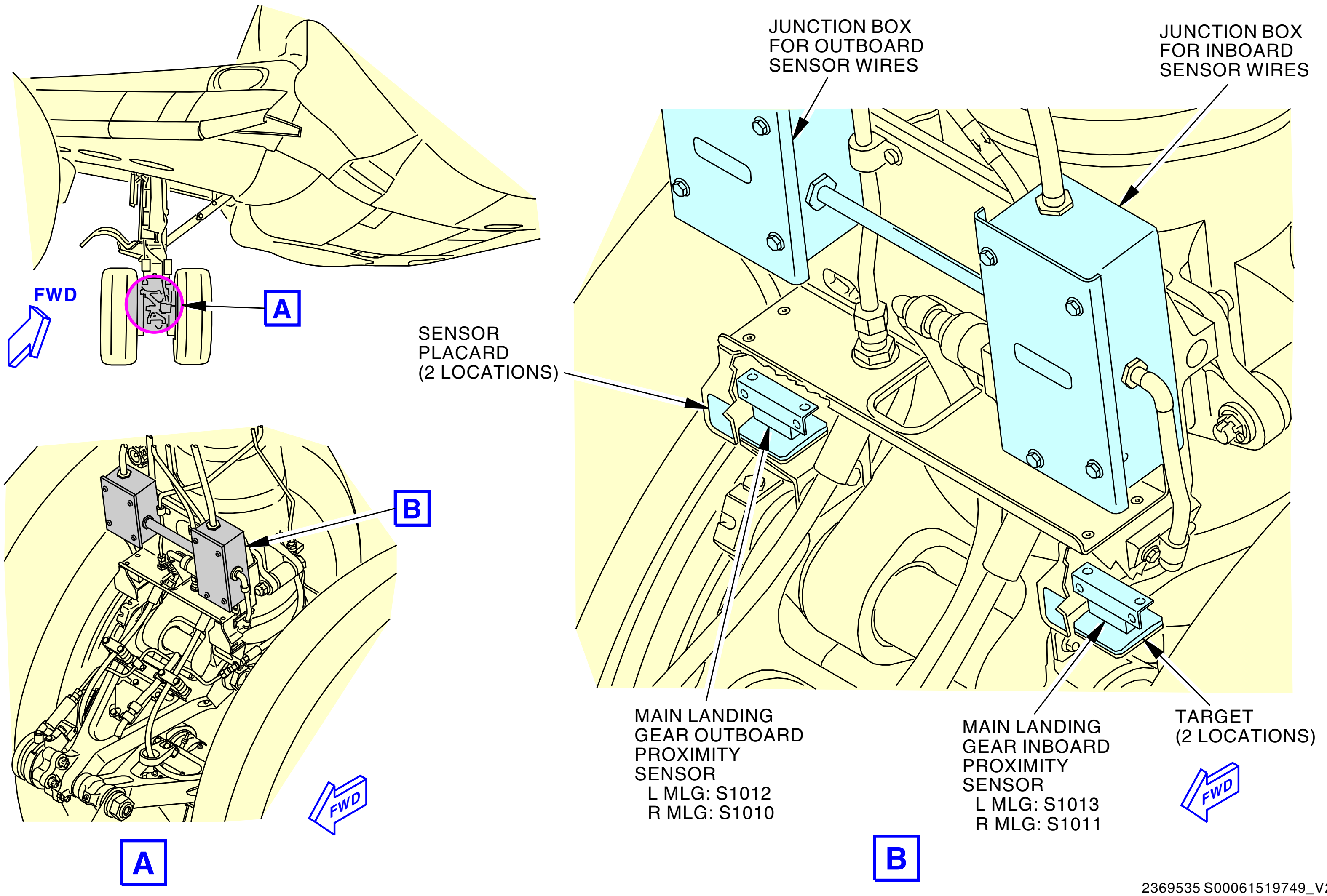
Junction boxes, one above each sensor, contain the sensor wire connections.

Functional Description

The targets are near the sensors when the main landing gear shock strut compresses and the airplane is on the ground. This sends signals to the air/ground systems in the Proximity Switch Electronic Unit (PSEU). The PSEU detects the change in sensor inductance and considers the sensor status as target near. If the target is outside the sensing range, the status of the sensor is set to target far.

If the PSEU detects a failed sensor, the sensor status is set to target far.

AIR/GROUND SYSTEM - MAIN LANDING GEAR PROXIMITY SENSORS



AIR/GROUND SYSTEM - MAIN LANDING GEAR PROXIMITY SENSORS

AIR/GROUND SYSTEM - NOSE LANDING GEAR PROXIMITY SENSORS

Purpose

Two nose landing gear proximity sensors supply nose landing gear shock strut compressed position signals to the air/ground system.

Physical Description

The landing gear proximity sensors are inductance type sensors. Each sensor has a metal target and a sensor.

Location

The nose landing gear proximity sensors are on each side of the upper torsion link where the link attaches to the outer cylinder of the nose landing gear. The targets are on the lower area of the outer cylinder of the nose landing gear.

The sensor identification placards on the sensor bracket show the sensor number. These are the NLG proximity sensor numbers:

Sensor Number	Location
S1014	Left
S1015	Right

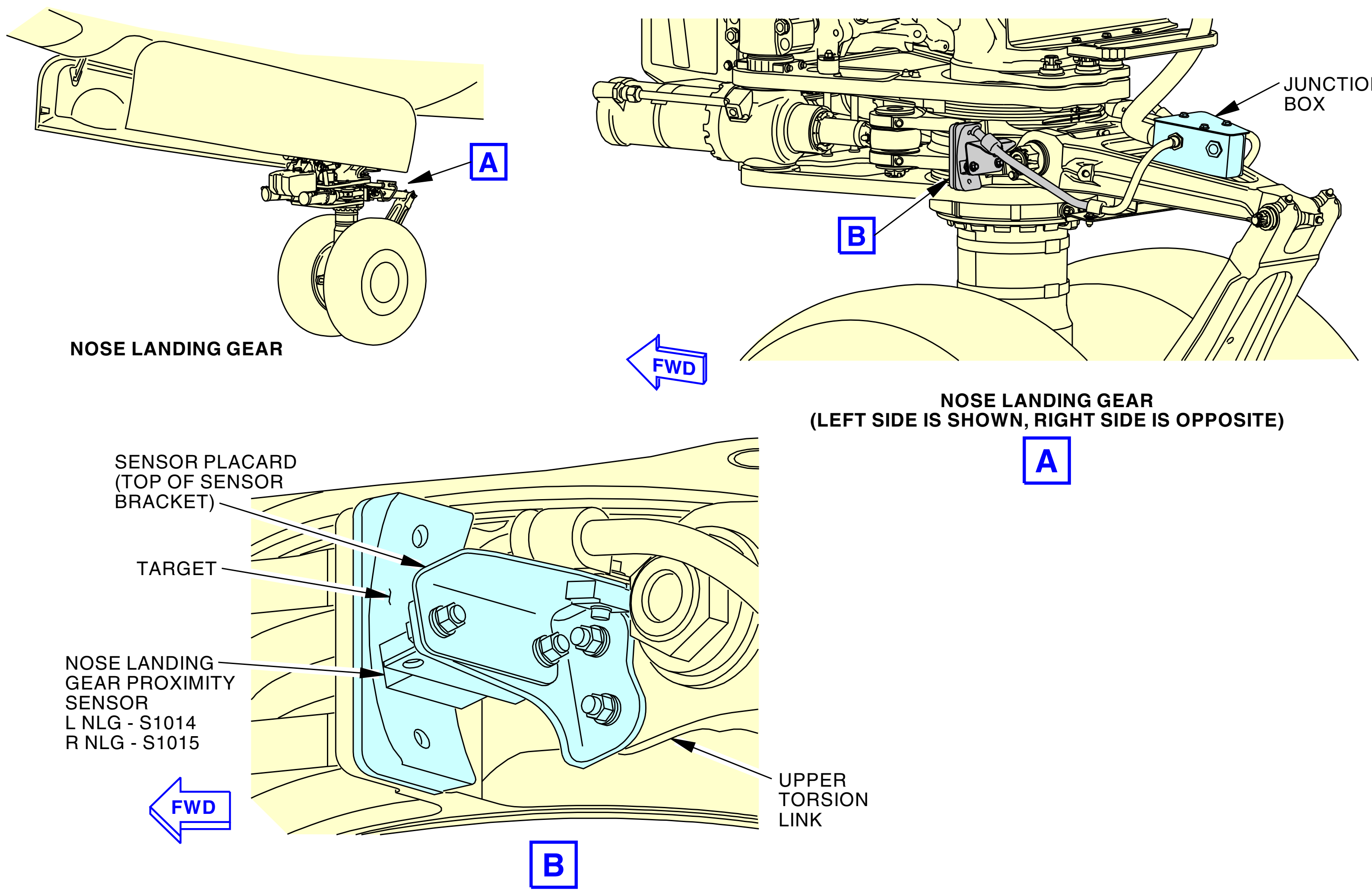
A junction box on the top of the upper torsion link contains the wire connections for both proximity sensors.

Functional Description

The targets are near the sensors when the nose landing gear shock strut compresses and the airplane is on the ground. This sends signals to the air/ground systems in the Proximity Switch Electronic Unit (PSEU) when the nose landing gear is on the ground. The PSEU detects the change in sensor inductance and sets the sensor status as target near. If the target is outside the sensing range, the status of the sensor is set to target far.

If the PSEU detects a failed sensor, the sensor status is set to target far.

AIR/GROUND SYSTEM - NOSE LANDING GEAR PROXIMITY SENSORS



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AIR/GROUND SYSTEM - NOSE LANDING GEAR PROXIMITY SENSORS

AIR/GROUND SYSTEM - AIR/GROUND RELAYS

Purpose

The air/ground relays supply air/ground signals to airplane systems.

Physical Description

The air/ground relays are hermetically sealed units, with a mounting bracket attached.

Location

The six system 1 air/ground relays are in the J22 junction box. Six system 2 air/ground relays are in the J20 junction box. One system 2 air/ground relay is in the J24 junction box and another system 2 air/ground relay is in the J39 junction box.

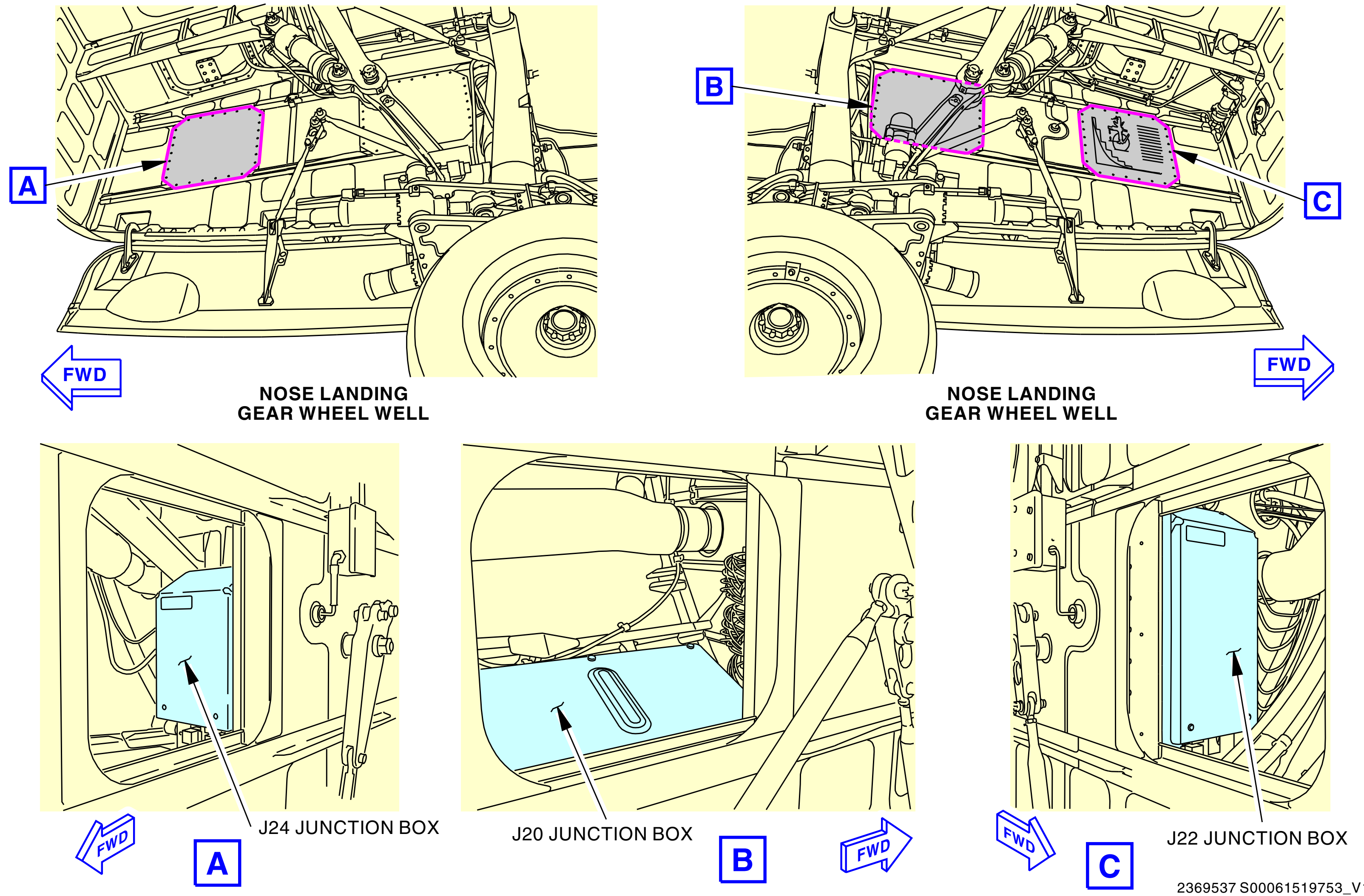
To get access to these junction boxes, go through the access panels on the left and right sides of the nose landing gear wheel well. The J39 junction box is in the electronics equipment compartment and is forward of the E-1 rack.

Functional Description

This table gives you information about the air/ground relays:

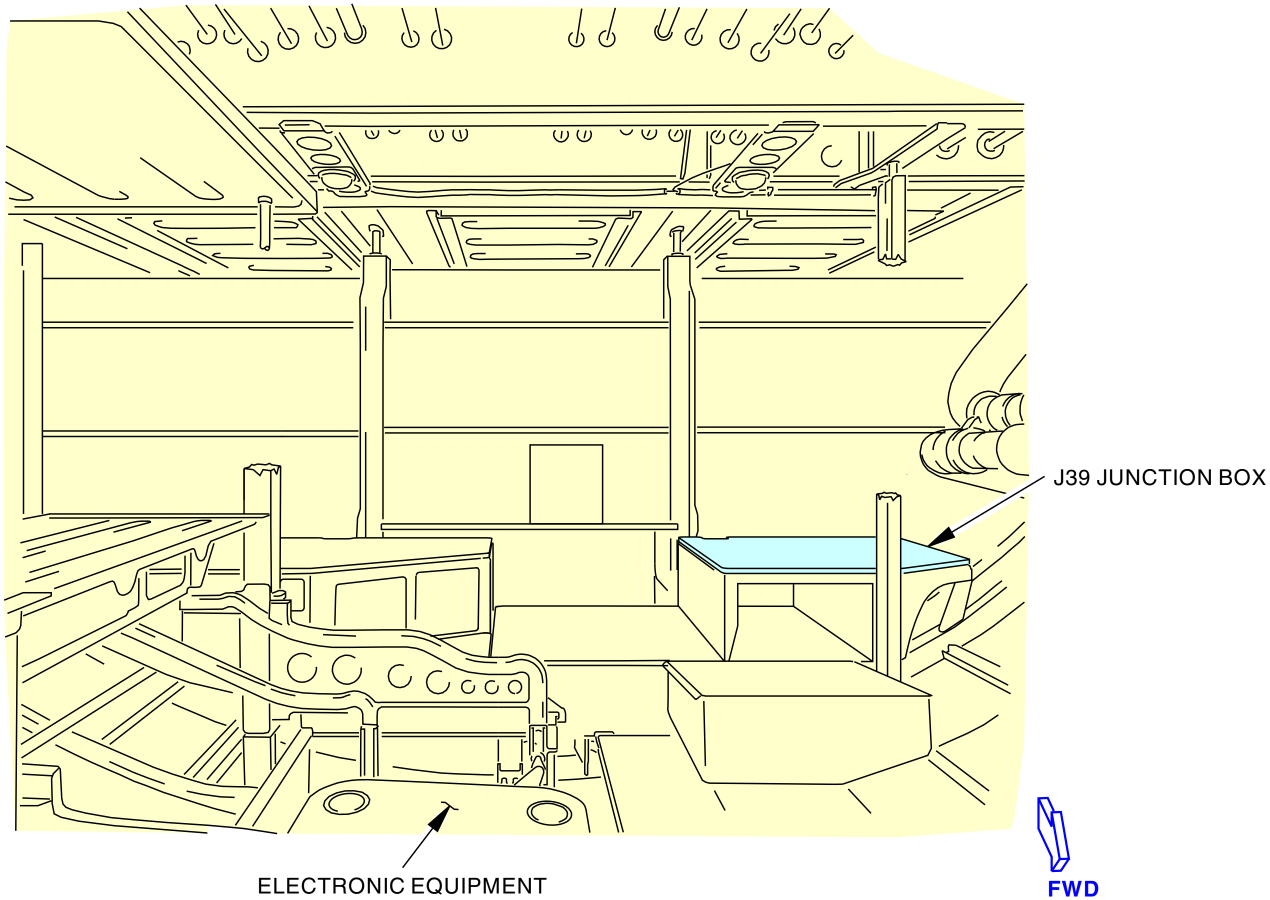
System	Relay	Junction Box	Energized
1	R584	J22	AIR
1	R587	J22	GROUND
1	R589	J22	GROUND
1	R592	J22	GROUND
1	R593	J22	AIR
1	R594	J22	GROUND
2	R819	J20	GROUND
2	R588	J20	AIR
2	R590	J20	GROUND
2	R591	J20	GROUND
2	R595	J20	GROUND
2	R596	J20	GROUND
2	R585	J24	AIR
2	R597	J39	GROUND

AIR/GROUND SYSTEM - AIR/GROUND RELAYS



AIR/GROUND SYSTEM - AIR/GROUND RELAYS

AIR/GROUND SYSTEM - AIR/GROUND RELAYS



ELECTRICAL AND ELETRONICS COMPARTMENT

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AIR/GROUND RELAYS

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AIR/GROUND SYSTEM - PROXIMITY SWITCH ELECTRONICS UNIT

Purpose

The proximity switch electronics unit (PSEU) controls seven airplane systems and provides air/ground relay and discretre outputs for multiple airplane systems. The PSEU also gives fault indication and maintenance BITE.

Location

The PSEU is in the forward equipment compartment. You get access to the PSEU through the access door on the bottom on the airplane, forward of the nose landing gear wheel well.

Physical Description

The PSEU is an LRU with two internal circuit cards (system 1 at the top and system 2 on the bottom). It is part of the Onboard Maintenance System (OMS). BITE monitors for internal faults and external faults on PSEU inputs. The PSEU ARINC 429 system 1 and system 2 transmitters send fault and status messages to the OMS for display in the flight compartment. The housing assembly has seven connectors that electrically attach the unit to the airplane.

The PSEU has these seven electrical connectors:

- J1-J4 are for system 1
- J5-J7 are for system 2.

Functional Description

The PSEU does these functions for the air/ground system:

- Monitors the landing gear compressed sensors
- Operates the air/ground relays
- Sends air/ground discrete signals.

The PSEU processes signals from the air/ground sensors and sends air/ground signals to airplane systems and air/ground relays.

The PSEU also does these functions:

- Landing gear position indication and warning
- Landing gear transfer valve control
- Landing gear selector valve control
- Takeoff (aural) warning
- Tail skid control
- Landing aural warning
- Landing gear lever latch
- BITE
- Door warning.

For more information about landing gear position indication and warning, see the landing gear position indication and warning system section.

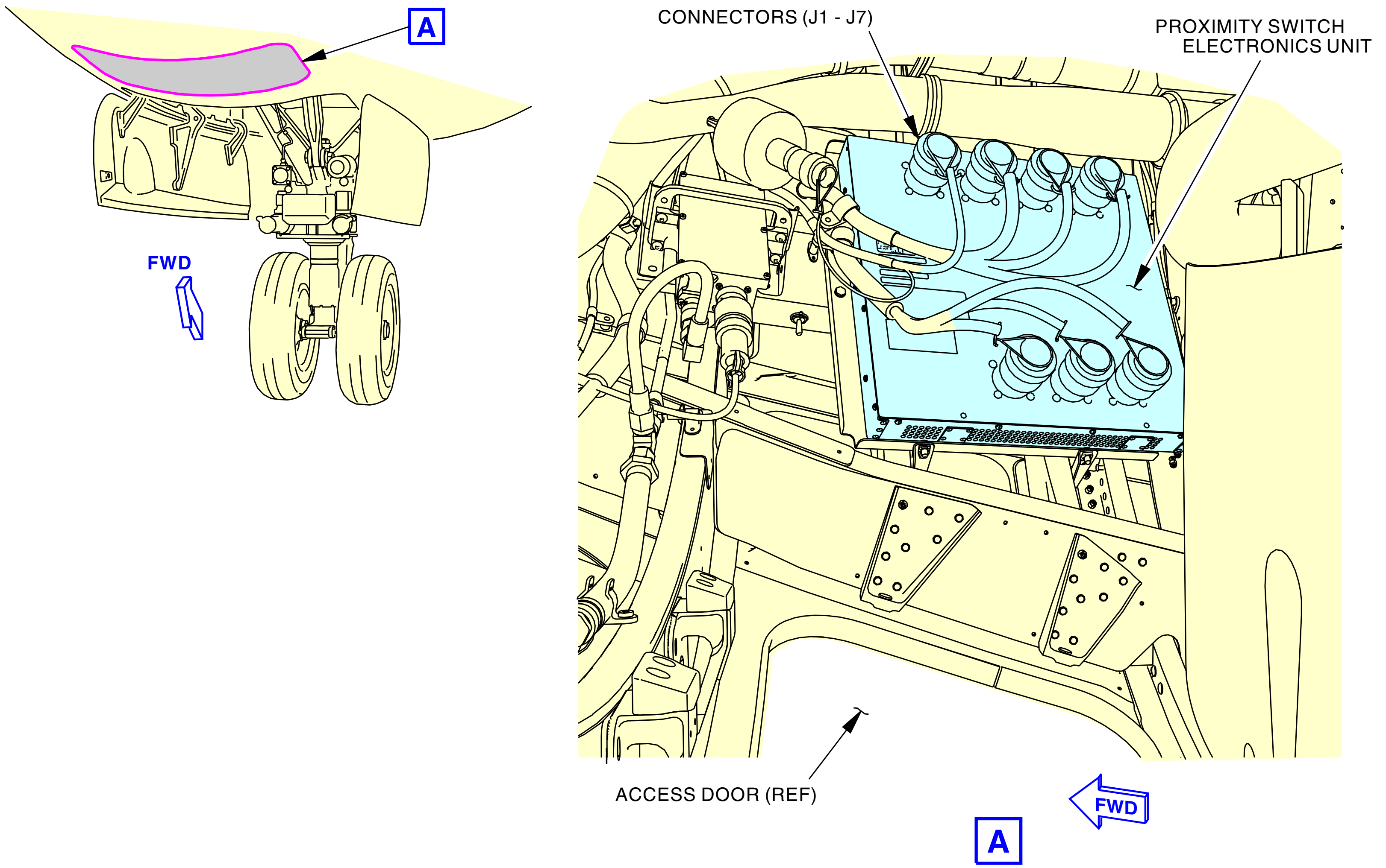
For more information about the landing gear transfer valve, see the landing gear control system section.

For more information about the landing gear selector valve, see the landing gear control system section.

For more information about the tail skid, see the tail skid section.

For more information about the door warning, see the door warning system section.

AIR/GROUND SYSTEM - PROXIMITY SWITCH ELECTRONICS UNIT



AIR/GROUND SYSTEM - PROXIMITY SWITCH ELECTRONICS UNIT

AIR/GROUND SYSTEM - AIR/GROUND DISCRETES - SYSTEM 1

Purpose

The proximity switch electronics unit (PSEU) provides air/ground discrete signal outputs for multiple airplane systems.

General Description

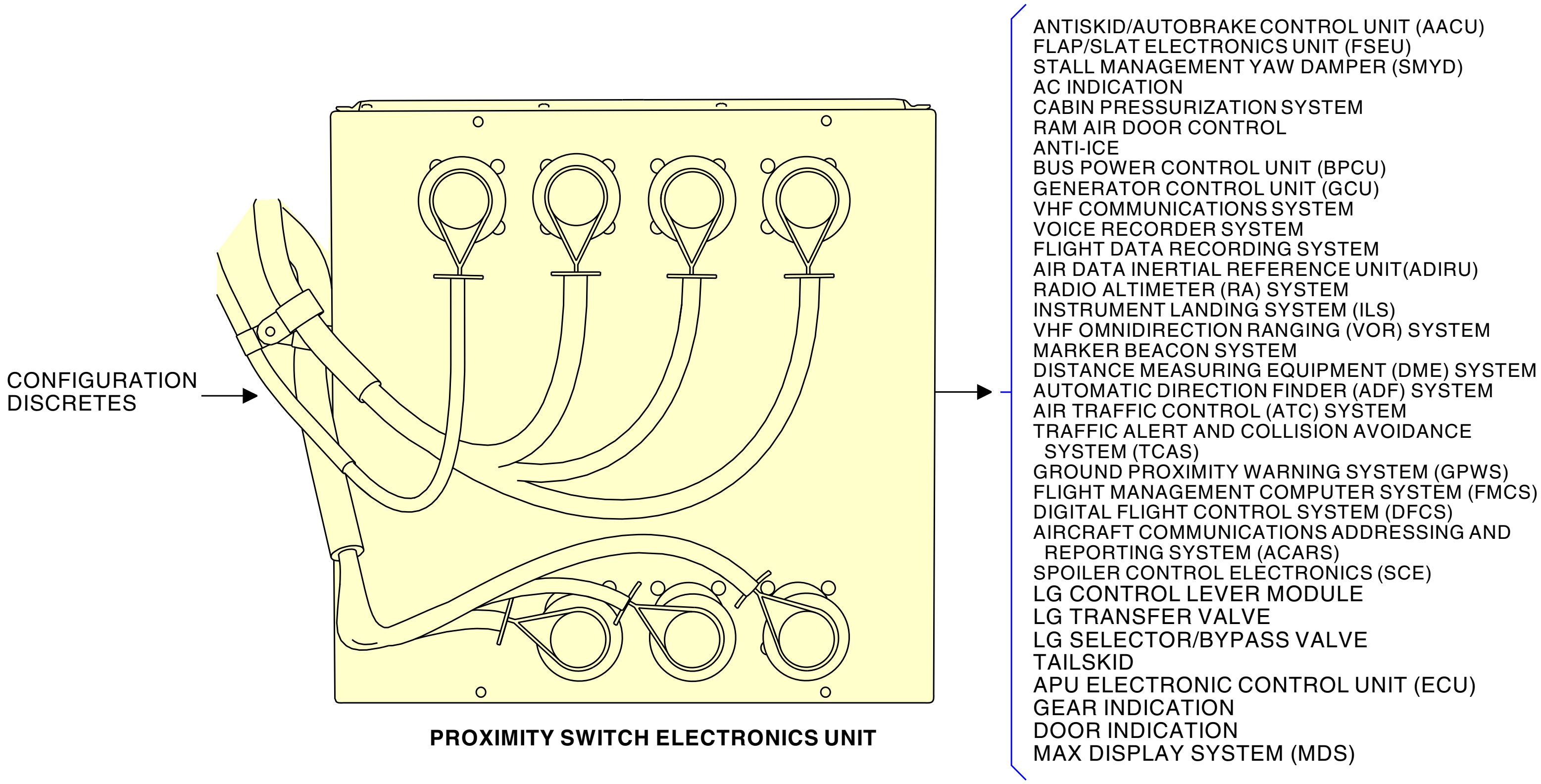
System 1 receives configuration discrete and sensor inputs from airplane components for use when calculating air/ground discrete outputs.

These are the multiple use systems/units that use air/ground discretes from system 1:

- Antiskid/autobrake control unit (AACU)
- Flap/slat electronics unit (FSEU)
- Stall management yaw damper (SMYD)
- AC indication
- Cabin pressurization system
- Ram air door control
- Anti-ice
- Bus power control unit (BPCU)
- Generator control unit (GCU)
- VHF communications system
- Voice recorder system
- Flight data recording system
- Air data inertial reference unit (ADIRU)
- Radio altimeter (RA) system
- Instrument landing system (ILS)
- VHF omnidirectional ranging (VOR) system
- Distance measuring equipment (DME) system
- Automatic direction finder (ADF) system
- Air traffic control (ATC) system
- Traffic collision avoidance system (TCAS)
- Ground proximity warning system (GPWS)
- Flight management computer system (FMCS)
- Digital flight control system (DFCS)
- Aircraft communications addressing and reporting system (ACARS)
- Spoiler control electronics (SCE)
- LG control lever module
- LG transfer valve
- LG selector/bypass valve
- Tailskid
- APU electronic control unit (ECU)
- Gear indication
- Door indication
- MAX display system (MDS).

Intercommunication between systems 1 and 2 is for internal and external fault monitoring.

AIR/GROUND SYSTEM - AIR/GROUND DISCRETES - SYSTEM 1



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AIR/GROUND SYSTEM - AIR/GROUND DISCRETES - SYSTEM 1

AIR/GROUND SYSTEM - AIR/GROUND DISCRETES - SYSTEM 2

Purpose

The proximity switch electronics unit (PSEU) provides air/ground discrete signal outputs for multiple airplane systems.

General Description

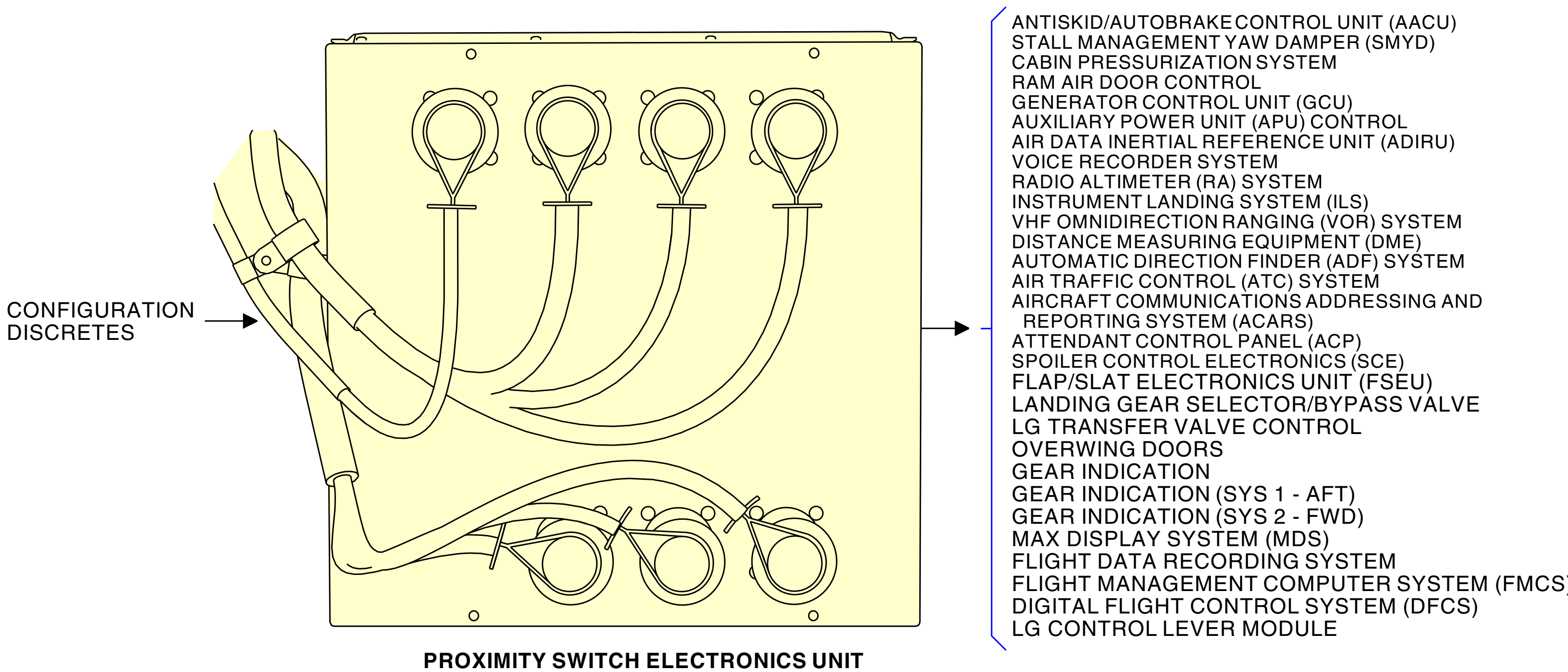
System 2 receives configuration discrete and sensor inputs from airplane components for use when calculating air/ground discrete outputs.

These are the multiple use systems/units that use air/ground discretes from system 2:

- Antiskid/autobrake control unit (AACU)
- Stall management yaw damper (SMYD)
- Cabin pressurization system
- Ram air door control
- Bus power control unit (BPCU)
- Generator control unit (GCU)
- Auxiliary power unit (APU) control
- Auxiliary power unit (APU) warning
- Flight data recording system
- Air data inertial reference system (ADIRU)
- Voice recorder system
- Radio altimeter system
- Instrument landing system (ILS)
- VHF omnidirectional ranging (VOR) system
- Distance measuring equipment (DME) system
- Automatic direction finder (ADF) system
- Air traffic control (ATC) system
- Flight management computer system (FMCS)
- Digital flight control system (DFCS)
- Aircraft communications addressing and reporting system (ACARS)
- Attendant control panel (ACP)
- Spoiler control electronics (SCE)
- Flap/slat electronics unit (FSEU)
- Landing gear selector/bypass valve
- LG transfer valve control
- Overwing doors
- Gear indication
- Gear indication (SYS 1 - AFT)
- Gear indication (SYS 2 - FWD)
- MAX display system (MDS)
- Flight data recording system
- Flight management computer system (FMCS)
- Digital flight control system (DFCS)
- LG control lever module.

Intercommunication between systems 1 and 2 is for internal and external fault monitoring.

AIR/GROUND SYSTEM - AIR/GROUND DISCRETES - SYSTEM 2



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AIR/GROUND SYSTEM - AIR/GROUND DISCRETES - SYSTEM 2

AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION - AIR/GROUND RELAYS - SYSTEM 1

Purpose

The PSEU controls the air/ground relays for multiple airplane systems.

General Description

System 1 relays receive configuration signals from the PSEU and electrical power from either BUS 1 or the BAT BUS. The PSEU also provides the electrical ground source to energize the relays in an air or ground mode.

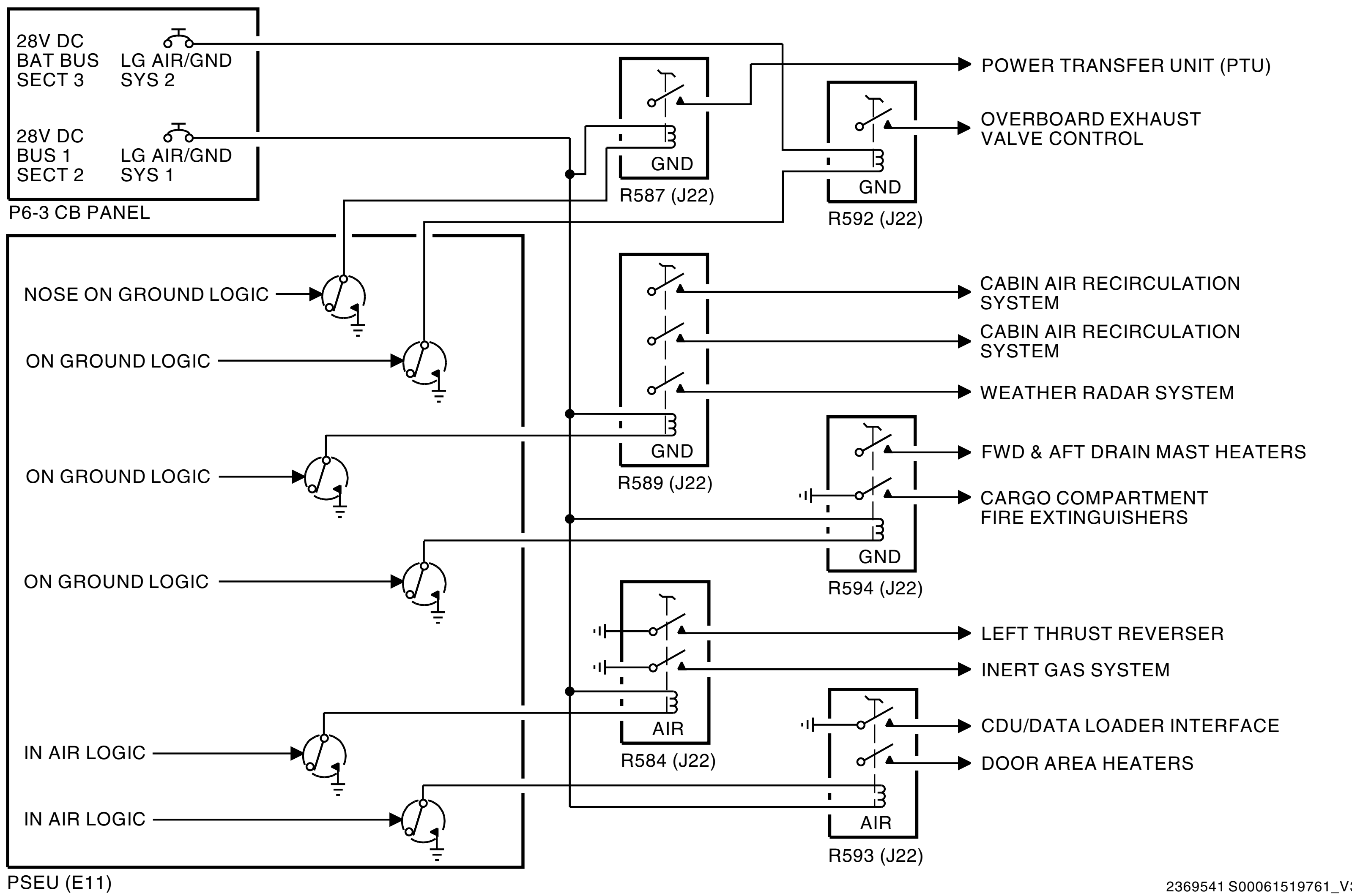
These are the air mode relays:

- R584 for the left thrust reverser and inert gas system
- R593 for the Control Display Unit (CDU) data loader interface and door area heaters.

These are the ground mode relays:

- R587 for the power transfer unit (PTU)
- R589 for the weather radar system and the cabin air recirculation system
- R592 for the overboard exhaust valve control
- R594 for the forward and aft drain mast heaters, and the cargo compartment fire extinguishers.

AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION - AIR/GROUND RELAYS - SYSTEM 1



AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION -AIR/GROUND RELAYS-SYSTEM 1

AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION - AIR/GROUND RELAYS - SYSTEM 2

Purpose

The PSEU controls the air/ground relays for multiple airplane systems.

General Description

System 2 relays receive configuration signals from the PSEU and electrical power from either BUS 2 or the BAT BUS. The PSEU also provides the electrical ground source to energize the relays in an air or ground mode.

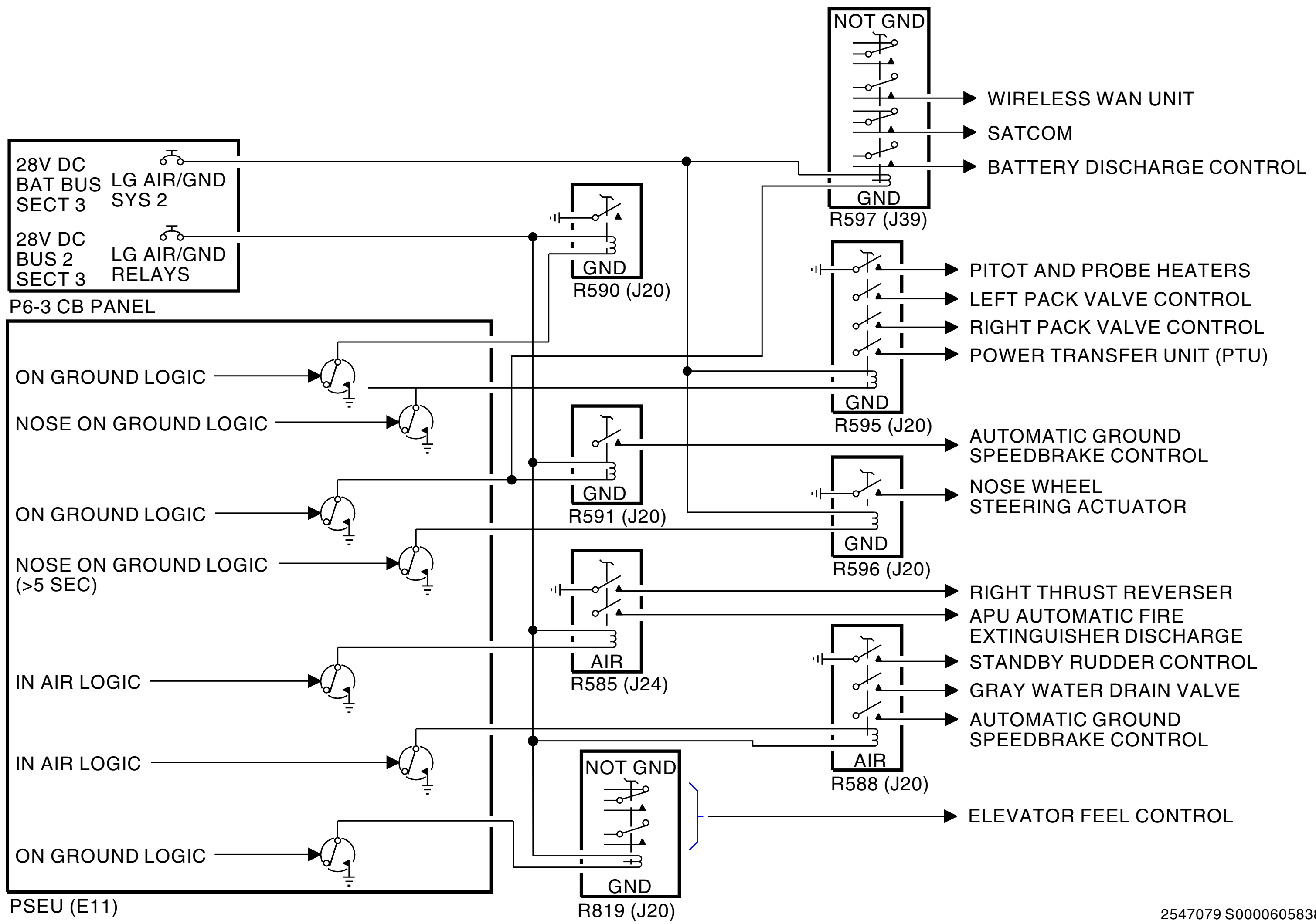
These are the air mode relays:

- R585 for the right thrust reverser and APU automatic fire extinguisher discharge.
- R588 for standby rudder control, the gray water drain valve, and automatic ground speedbrake control.

These are the ground mode relays:

- R591 for the automatic ground speedbrake control
- R595 for the pitot and probe heaters, the left and right pack valves, and power transfer unit (PTU)
- R596 for the nose wheel steering actuator.

AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION - AIR/GROUND RELAYS - SYSTEM 2



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AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION - AIR/GROUND RELAYS - SYSTEM 2

AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION

Purpose

The air/ground system supplies air/ground data to airplane systems.

Functional Description

Inputs from the system 1 sensors go to system 1 in the proximity switch electronics unit (PSEU), and inputs from system 2 sensors go to system 2 in the PSEU. Both systems within the PSEU share information through a common bus.

Two landing gear compressed sensors on each landing gear send air/ground position to the PSEU. The PSEU processes the signals from the compressed sensors, operates the air/ground relays, and sends these outputs to airplane systems:

- Ground mode
- Air mode
- Left gear on ground mode (system 1 only)
- Right gear on ground mode (system 2 only)
- Nose gear on ground mode
- Parking brake set on ground (system 1 only).

System 1 sends ground mode signals to the system 1 air/ground relays and airplane systems when targets move near any two or more of the system 1 and system 2 MLG compressed sensors.

System 1 sends air mode signals to the system 1 air/ground relays and airplane systems when targets move far from any three of the system 1 and system 2 MLG compressed sensors.

System 1 sends nose gear on ground mode signals to airplane systems when targets move near any two or more MLG compressed sensors and one or both NLG compressed sensors.

System 1 only sends a left gear on ground mode signal to the digital flight data acquisition unit (DFDAU) when targets move near one or both left main landing gear compressed sensors.

System 1 also sends a nose gear on ground mode signals to the digital flight data acquisition unit (DFDAU) when targets move near one or both nose landing gear compressed sensors.

See the flight data recorder system (FDRS) section for more information about the DFDAU. (SECTION 31-31)

System 1 only sends parking brake set, and on ground signals to the voice recorder. This lets you erase the voice recorder when the parking brake is set and the airplane is on the ground.

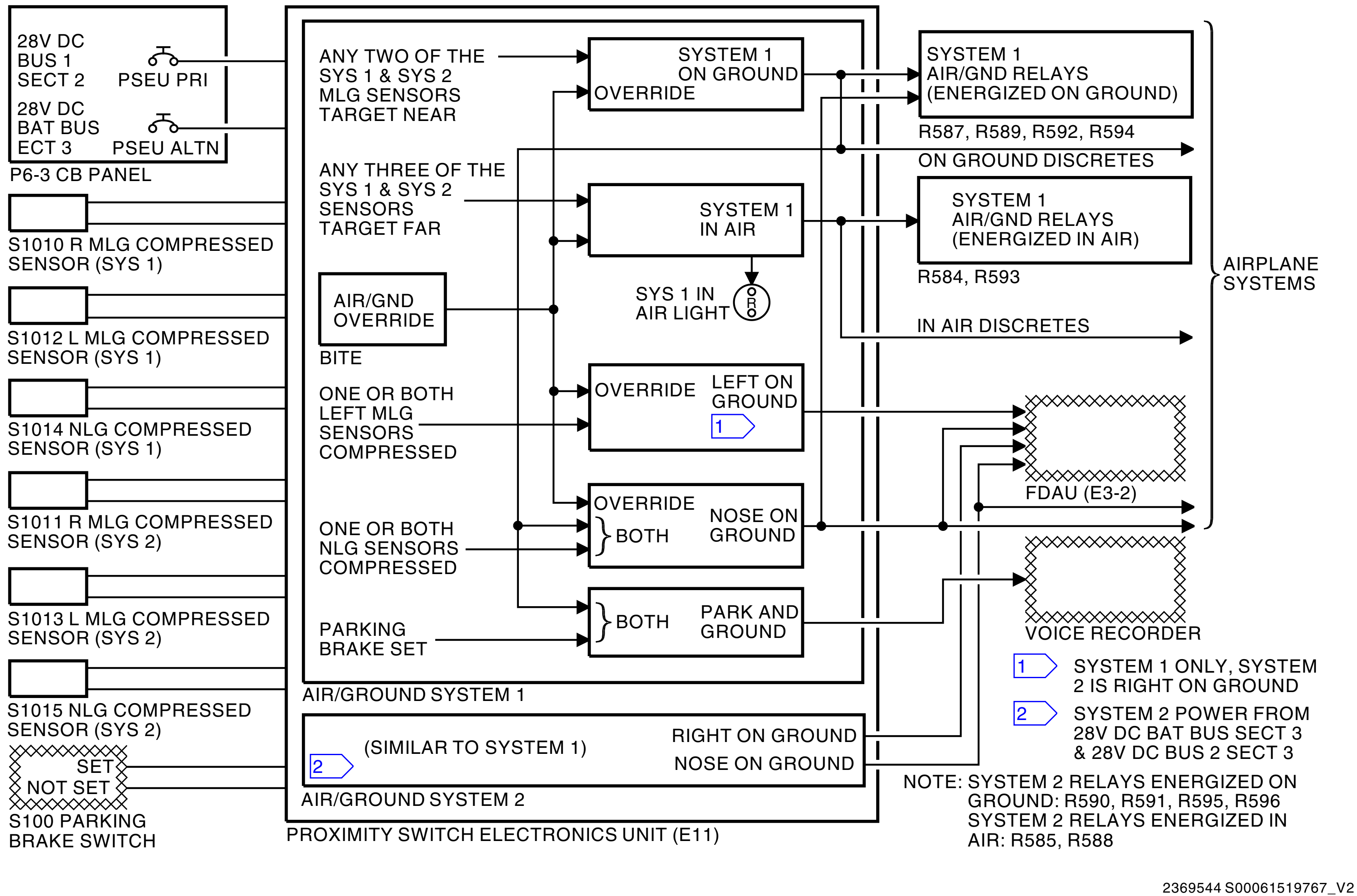
See the voice recorder system section for more information about the voice recorder. (SECTION 23-71)

Signals for system 2 are the same as system 1 except:

- System 2 sends a right gear on ground mode signal to the DFDAU when targets move near one or both right main landing gear compressed sensors
- System 2 sends nose on ground mode signals to the DFDAU in addition to other airplane systems
- System 2 does not send parking brake set on ground signals.

You can change the output of each air/ground system with the AIR/GND OVRD function in the PSEU special functions on the Multi-Function Display (MFD). The air/ground system in air red lights and MAINT amber light come on when the system is in the air mode.

AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION



AIR/GROUND SYSTEM - FUNCTIONAL DESCRIPTION

MAIN LANDING GEAR AND DOORS - GENERAL DESCRIPTION - 1

General

The two main landing gear (MLG) absorbs landing forces and holds most of the airplane weight when the airplane is on the ground. The main landing gear also transmits the braking forces to the airplane structure.

The main landing gear doors open to permit gear operation. They close to aerodynamically seal the main landing gear wheel well.

Main Landing Gear Components

Each main landing gear has two wheel assemblies.

Each main landing gear has these components:

- Shock strut
- Drag strut
- Side strut
- Gas and oil charging valves
- Walking beam
- Reaction link
- Torsion links
- Shimmy damper
- Axle assembly
- Jack pad
- MLG doors
- MLG wheel well seals

Shock Strut

The main gear shock strut is the primary supporting member of the landing gear. The shock strut consist of an integral drag strut, and an outer and inner cylinder. When the shock strut retracts or extends it rotates about two trunnion bearings and pins at the top of the outer shock strut. Each pin extends through a trunnion bearing and support in the wing and beam assembly. Trunnion bolts keep the trunnion pins from backing out during landing gear operation.

Drag Strut

The drag strut stabilizes the shock strut in a fore and aft direction. The drag strut is an integral part of the shock strut.

Side Strut

The side strut holds the main landing gear in the extended position.

The side strut consists of an upper and lower side strut, hinged near the center. The lower end of the lower side strut connects to the shock strut. The upper end of the upper side strut connects to the reaction link. The side strut folds about the hinge when the gear retracts.

Gas and Oil Charging Valves

The shock strut uses hydraulic fluid and compressed dry air or nitrogen to control the shock strut action. The gas charging valve allows for pressurization of the shock strut. The oil charging valve allows for hydraulic servicing of the shock strut.

Walking Beam

The walking beam decreases the forces that go to the structure during actuator operations.

Reaction Link

The reaction link transfers most of the side loads from the landing gear to the upper end of the shock strut.

The reaction link is the upper member of a space frame that consists of these components:

- Shock strut
- Side strut
- Reaction link.

The outboard end of the reaction link connects to the shock strut. The inboard end connects to the structure at the main gear uplock brackets.

MAIN LANDING GEAR AND DOORS - GENERAL DESCRIPTION - 1

Torsion Links

The torsion links prevent the inner shock strut from rotation in the outer shock strut. This also permits movement up and down of the inner shock strut in the outer shock strut.

The torsion links consist of two parts, an upper and lower link connected in the center. The upper end of the upper link connects to the outer shock strut. The lower end of connects to the inner shock strut. A shimmy damper connects to the lower link.

Shimmy Damper

The main gear shimmy damper decreases vibration between the inner and outer cylinders during high speed taxi and heavy brake use.

Axle Assembly

The main landing gear axle attaches to the bottom of the inner cylinder. You can remove and replace the axle and brake sleeve if they are damaged.

Jack Pad

A jack pad on the bottom of the shock strut lets you move the inner cylinder up for wheel and tire replacement.

MLG Doors

These are the three doors for each main landing gear:

- Outer door
- Center door
- Inner door.

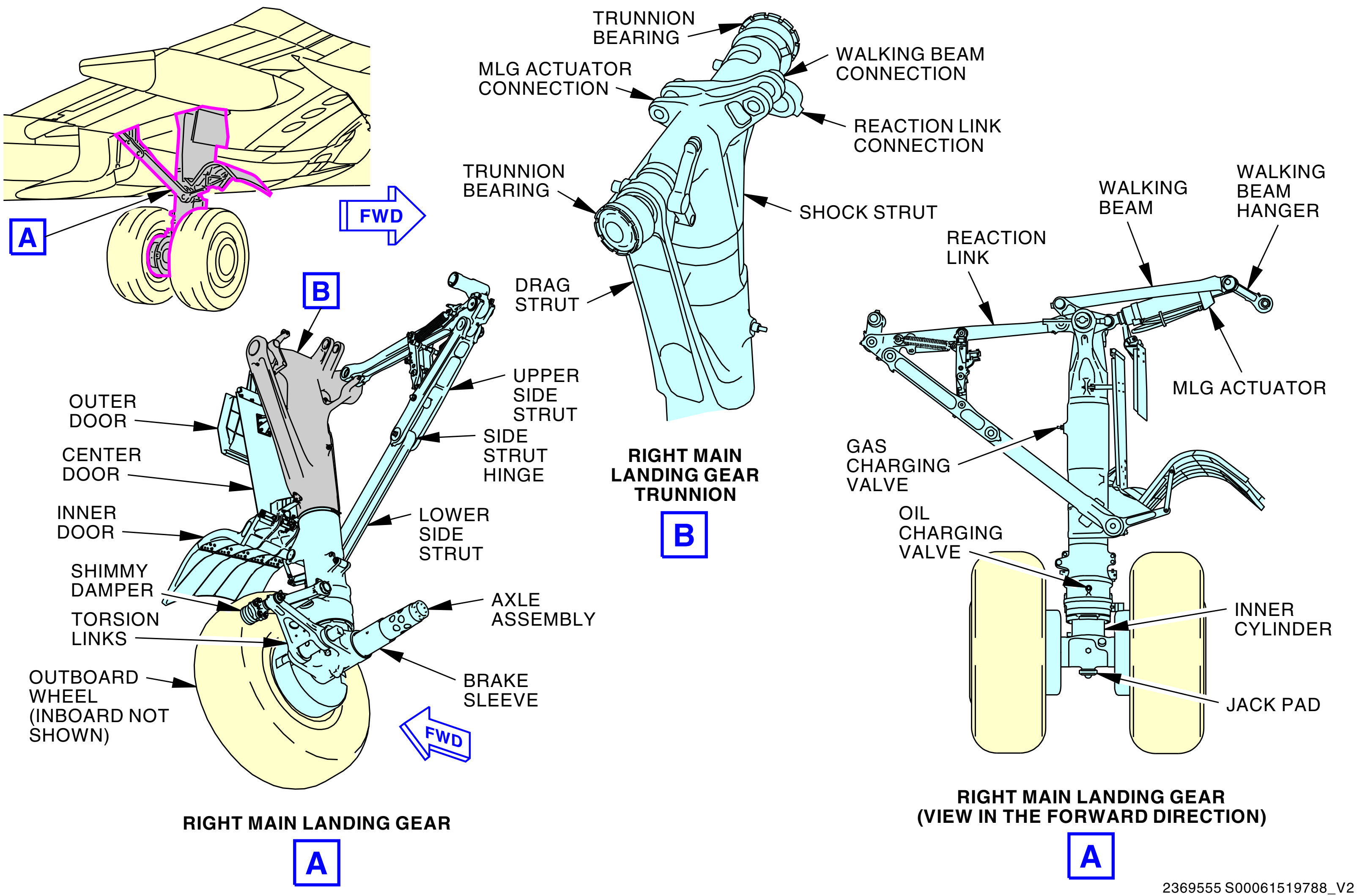
The main landing gear doors cover the opening in the wing for the shock strut when the main landing gear retracts.

MLG Wheel Well Seals (Not Shown)

There are no wheel well doors. The blade-type seals around the openings in the bottom of the main landing gear wheel well (not shown) make an aerodynamic seal around the outboard tire when the main landing gear retracts.

The outboard surface of the outboard wheels operate as aerodynamic covers for the main gear wheel when the main landing gear retracts.

MAIN LANDING GEAR AND DOORS - GENERAL DESCRIPTION - 1



MAIN LANDING GEAR AND DOORS - GENERAL DESCRIPTION - 1

MAIN LANDING GEAR AND DOORS - SHOCK STRUT SEALS

Purpose

The main landing gear shock struts are air-oil shock absorbers. They have an inner cylinder that moves in an outer cylinder. The seals provide an air-oil seal between the two cylinders.

Location

A static and a dynamic seal between the inner and outer cylinders keep the mixture of nitrogen and hydraulic fluid in the shock strut.

Physical Description

The seals are an elastomer type seal.

Functional Description

There are two spare static seals and two spare dynamic seals in the shock strut. These let you remove and replace defective seals without removal of the inner cylinder.

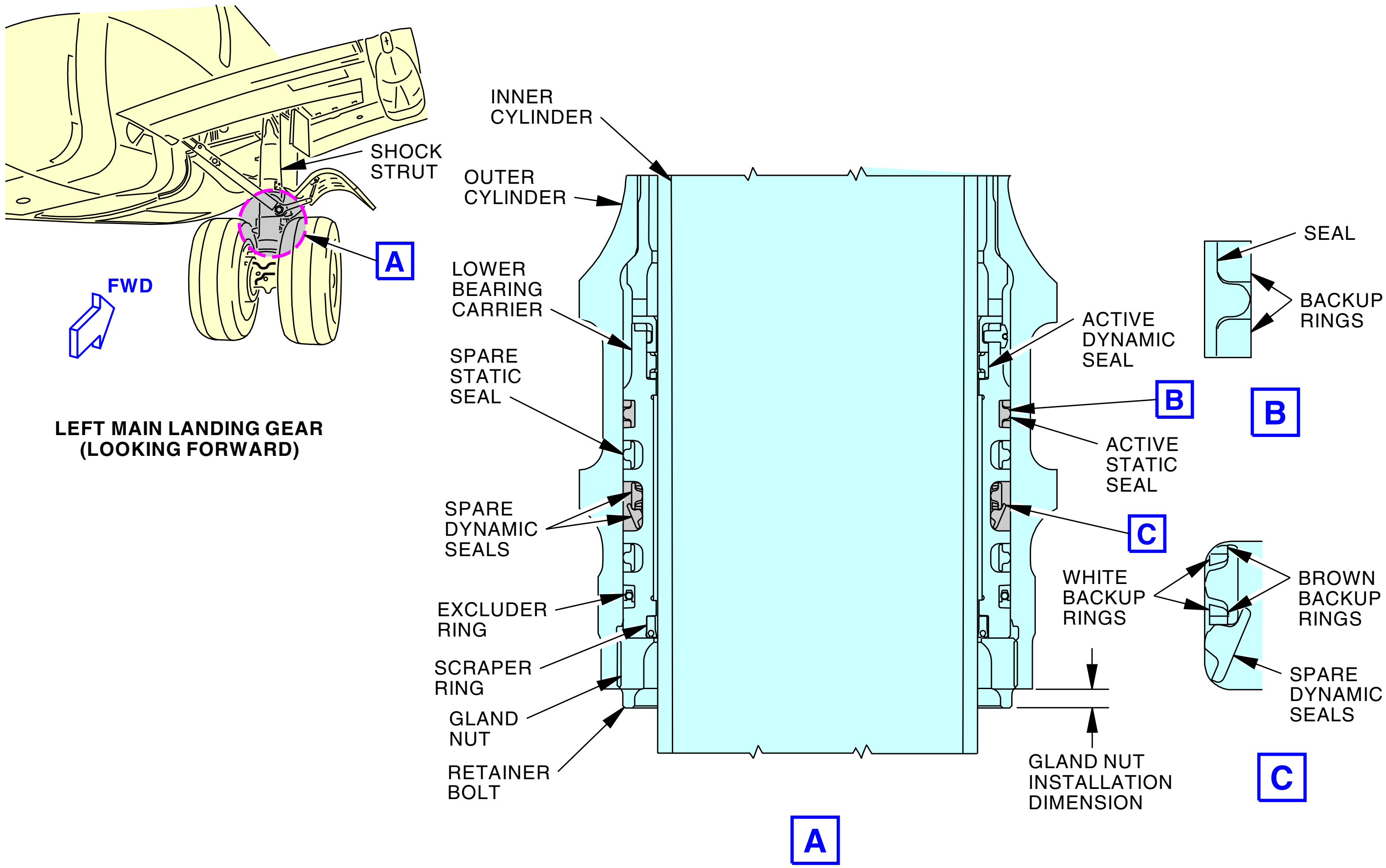
The lower bearing carrier hold the active and spare seals.

The excluder ring protects the spare seals from external contamination and ozone damage.

The scraper ring protects the inner and outer strut components from unwanted material.

The gland nut and retainer bolt hold the lower bearing carrier in-place.

MAIN LANDING GEAR AND DOORS - SHOCK STRUT SEALS



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MAIN LANDING GEAR AND DOORS - SHOCK STRUT SEALS

MAIN LANDING GEAR AND DOORS - MAIN LANDING GEAR DOORS

General

The MLG shock strut doors open to let the main landing gear extend and they aerodynamically seal the opening in the lower surface of the wing and the wing-to-body fairing when the main landing gear retracts.

The main landing gear doors have these components:

- Outer door
- Center door
- Inner door.

Location

The outer door connects by a hinge to the airplane wing structure along the upper edge of the door.

The center door connects to the shock strut by two adjustable tie rods at the top and brackets at the bottom.

The inner door connects by a hinge to the bottom of the center door.

Physical Description

The main landing gear doors are made of aluminum alloy materials.

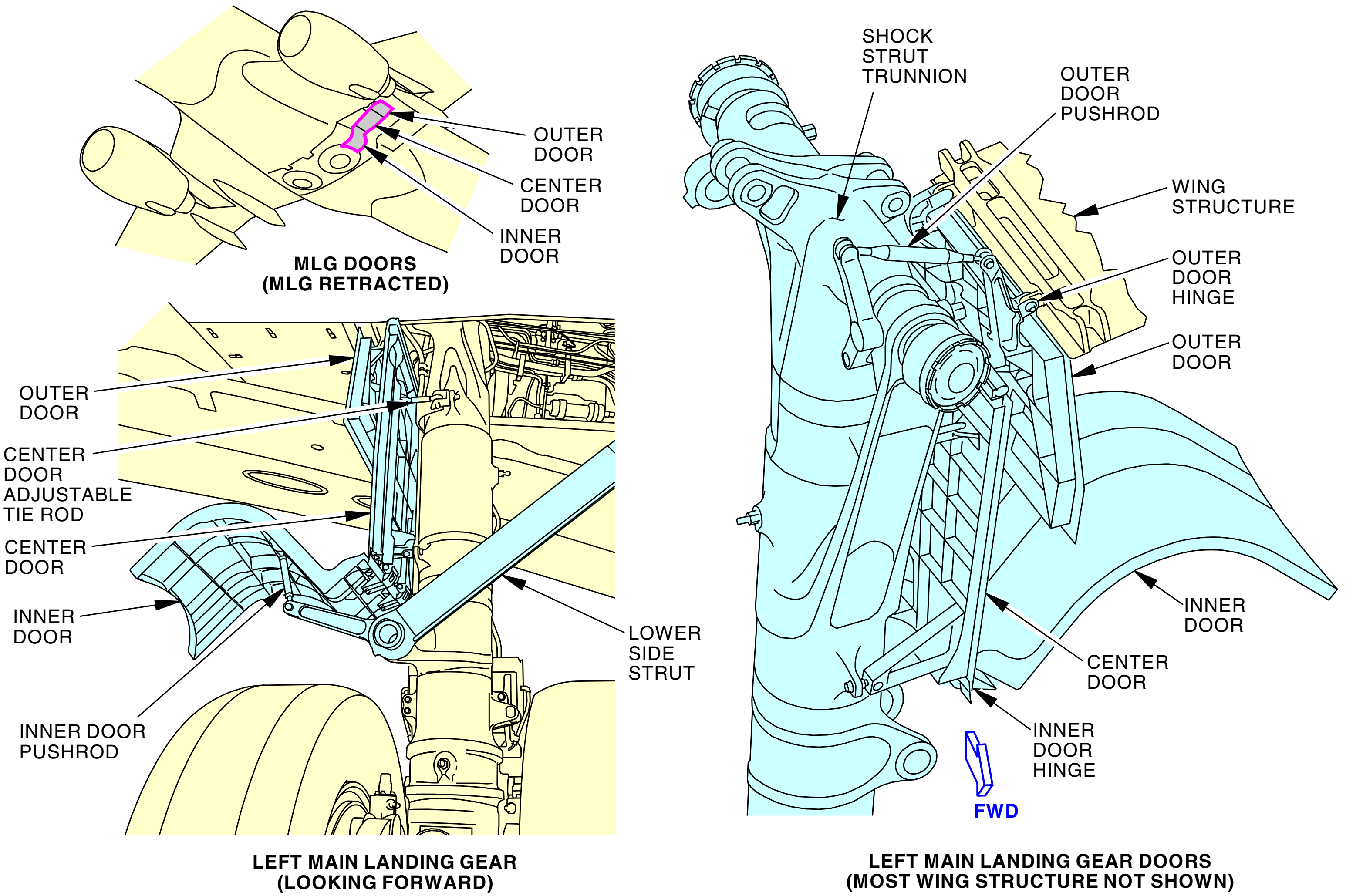
Functional Description

The outer door connects to an adjustable pushrod that also connects to the shock strut trunnion. As the gear retracts (or extends), the trunnion pulls (or pushes) the pushrod and seals the outer door against the wing opening.

The center door connects to the shock strut and does not move. Tie rods at the top allow for adjustment.

The inner door connects to an adjustable pushrod that also connects to the lower side strut. As the gear retracts (or extends), the side strut pulls (or pushes) the pushrod and seals the inner door against the wheel well opening and main landing gear tire.

MAIN LANDING GEAR AND DOORS - MAIN LANDING GEAR DOORS



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MAIN LANDING GEAR AND DOORS - MAIN LANDING GEAR DOORS

MAIN LANDING GEAR AND DOORS - WHEEL WELL BLADE SEALS

Purpose

There are no wheel well doors. The outboard surface of the outboard wheels have aerodynamic covers over the main landing gear wheel well.

Location

The wheel well blade seals attach around the wheel openings in the bottom of the main landing gear wheel well. The seals attach to the airplane structure with bolts.

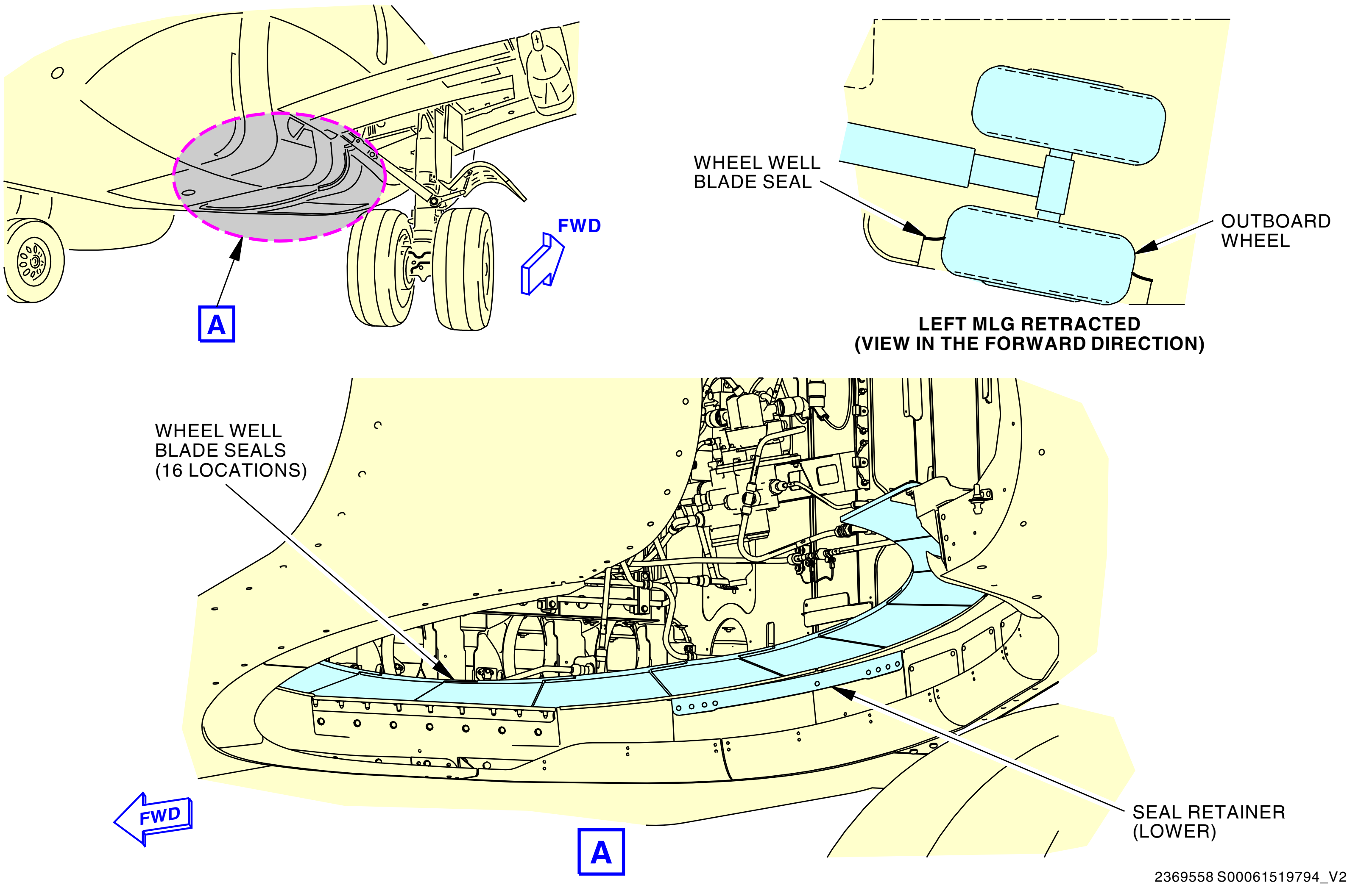
Physical Description

The wheel well blade seals consist of series of rubber blade-type segments. The segments are held in place by a series of seal retainers.

Functional Description

The wheel well blade seal system supplies an aerodynamic seal around the outboard tire when the main landing gear retracts.

MAIN LANDING GEAR AND DOORS - WHEEL WELL BLADE SEALS



MAIN LANDING GEAR AND DOORS - WHEEL WELL BLADE SEALS

MAIN LANDING GEAR AND DOORS - MAIN GEAR SHIMMY DAMPER

Purpose

The main gear shimmy damper decreases vibration between the inner and outer cylinders during high speed taxi and heavy brake use.

Location

The body of the main gear shimmy damper attaches to the forward end of the upper torsion link.

Physical Description

The main gear shimmy damper contains these components:

- Housing assembly
- Piston
- Bleed plugs
- Manifold assembly
- Inlet check valve
- Relief valve
- Compensator.

Functional Description

Vibration between the inner and outer cylinders causes the inner cylinder to turn inside the outer cylinder. This causes the main gear shimmy damper piston to move from side to side inside the housing assembly.

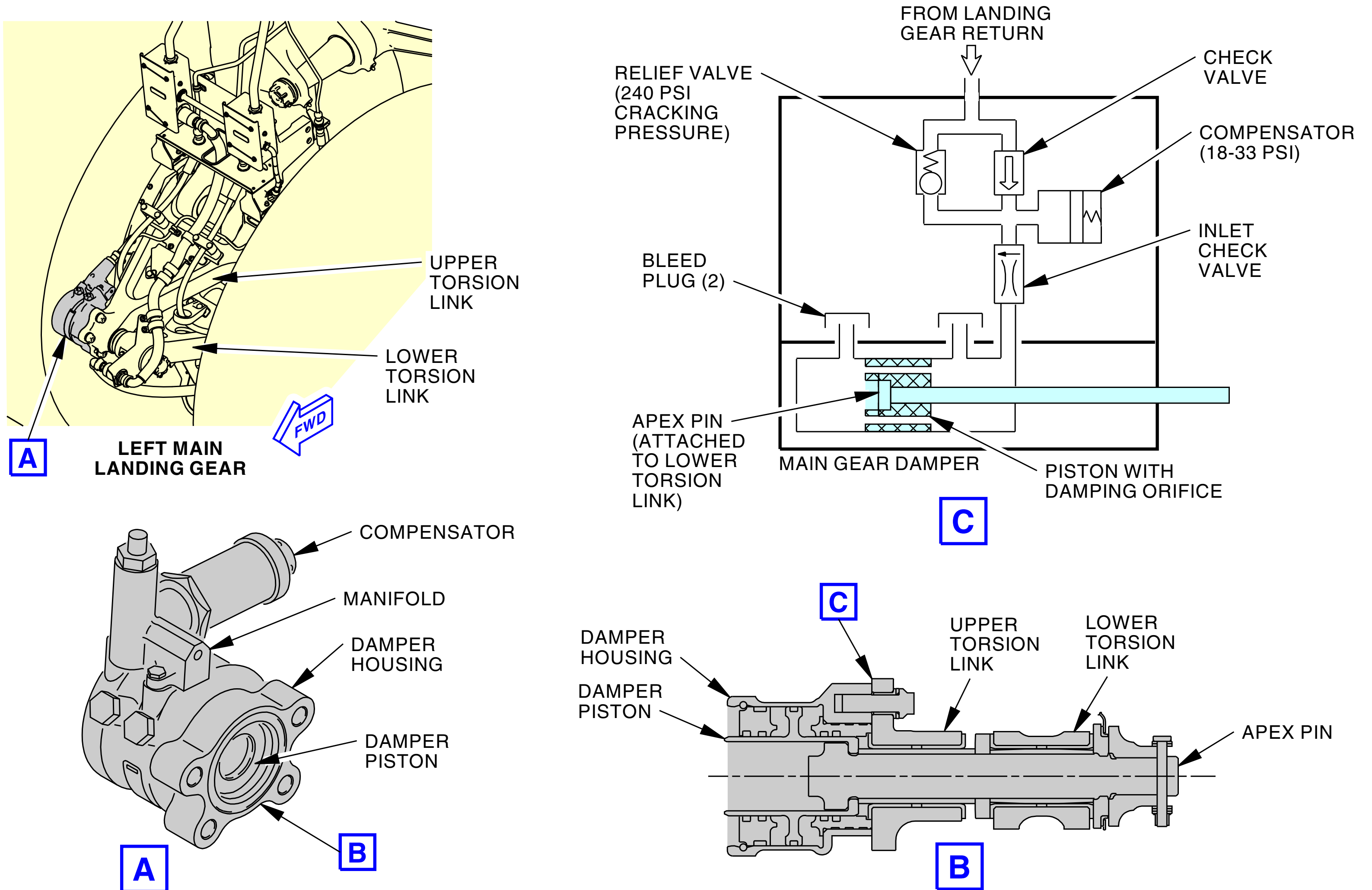
When the piston moves, hydraulic fluid moves through the damping orifices. This decreases piston movement. The damper connects to the return line of the main landing gear actuator.

The compensator maintains system pressure between 18 and 33 psi.

The inlet check valve controls the hydraulic fluid flow rate into the damper to 70 cu in/min at 50 psi. It also controls the fluid that leaves the damper to 14 cu in/min at 3750 psi.

The relief valve protects the compensator if the pressure increases to more than 240 psi.

MAIN LANDING GEAR AND DOORS - MAIN GEAR SHIMMY DAMPER



MAIN LANDING GEAR AND DOORS - MAIN GEAR SHIMMY DAMPER

NOSE LANDING GEAR AND DOORS - GENERAL DESCRIPTION

General

The nose landing gear absorbs landing forces and holds the forward part of the airplane weight when the airplane makes a landing.

The nose landing gear doors open to permit gear operation. They close to aerodynamically seal the nose landing gear wheel well.

Nose Landing Gear Components

The nose landing gear has two wheel assemblies.

The nose landing gear has these components:

- Shock strut
- Drag strut
- Lock link
- Gas and oil charging valves
- Torsion links
- Integral axle
- Tow fitting
- Jack pad
- NLG doors.

Shock Strut

The nose gear shock strut supports the nose of the airplane. The shock strut consists of an outer and inner cylinder. The shock strut also has two centering cams, one in the outer cylinder and one in the inner cylinder. The center cams hold the nose wheels in a straight line position for gear extension or retraction.

When the shock strut retracts or extends, it rotates around two trunnion bearing and pins at the top of the outer drag strut. Each pin extends through a trunnion bearing and support in the nose wheel well aft lower side wall structure. Trunnion bolts keep the trunnion pins from backing out during landing gear operation.

The right trunnion pin also has a hydraulic swivel assembly connected. This permits the use of rigid hydraulic lines.

The left trunnion pin is hollow. Two nose wheel steering cables go through the pin and the left nose wheel aft lower side wall structure for nose wheel steering control.

Drag Strut

A drag strut holds the nose gear in the extended or retracted position.

The drag strut consists of an upper and lower link, hinged in the center. The drag strut folds about the hinge during landing gear operation. The lower end of the lower drag strut connects to the shock strut outer cylinder. The upper end of the upper drag strut connects to the nose wheel well forward upper side wall structure.

When the landing gear operates, the drag strut rotates around two trunnion pins at the top of the upper drag strut. Each pin extends through a trunnion bearing and support in the nose wheel well forward upper side wall structure. Trunnion bolts keep the trunnion pins from backing out during landing gear operation.

Lock Mechanism

A lock mechanism moves to an over-center position to lock the drag strut in the up and the down positions. The lock mechanism also stabilizes the drag strut in the fore and aft direction. The lock mechanism consists of two lock links, two springs, and a lock actuator.

Lock actuator

The lock actuator moves the lock mechanism to the locked position when the nose landing gear is up or down.

Nose Landing Gear Actuator

The nose landing gear actuator supplies the force to retract and extend the nose landing gear.

NOSE LANDING GEAR AND DOORS - GENERAL DESCRIPTION

Gas and Oil Charging Valves

The shock strut uses hydraulic fluid and compressed dry air or nitrogen to control the shock strut action. The gas charging valve lets you pressurize the shock strut. The oil charging valve permits hydraulic servicing of the shock strut.

Torsion Links

The torsion links prevent the inner shock strut from rotation in the outer shock strut except when a steering force is applied. The torsion links also permit movement up and down of the inner shock strut in the outer shock strut.

The torsion links consist of an upper and lower link connected at the aft ends. The forward end of the upper link connects to a steering collar on the outer shock strut. The forward end of the lower link connects to the inner shock strut. Steering forces applied to the upper torsion link by the steering system are transmitted to the inner cylinder by the lower link.

You can disconnect the torsion links to let the nose landing gear move more than the normal steering limits of 78 degrees.

Integral Axle

The main landing gear axle attaches to the bottom of the inner cylinder. You can not remove the axle if it gets damaged.

Jack Pad

A jack pad on the bottom of the shock strut lets you move the inner cylinder up for wheel and tire replacement.

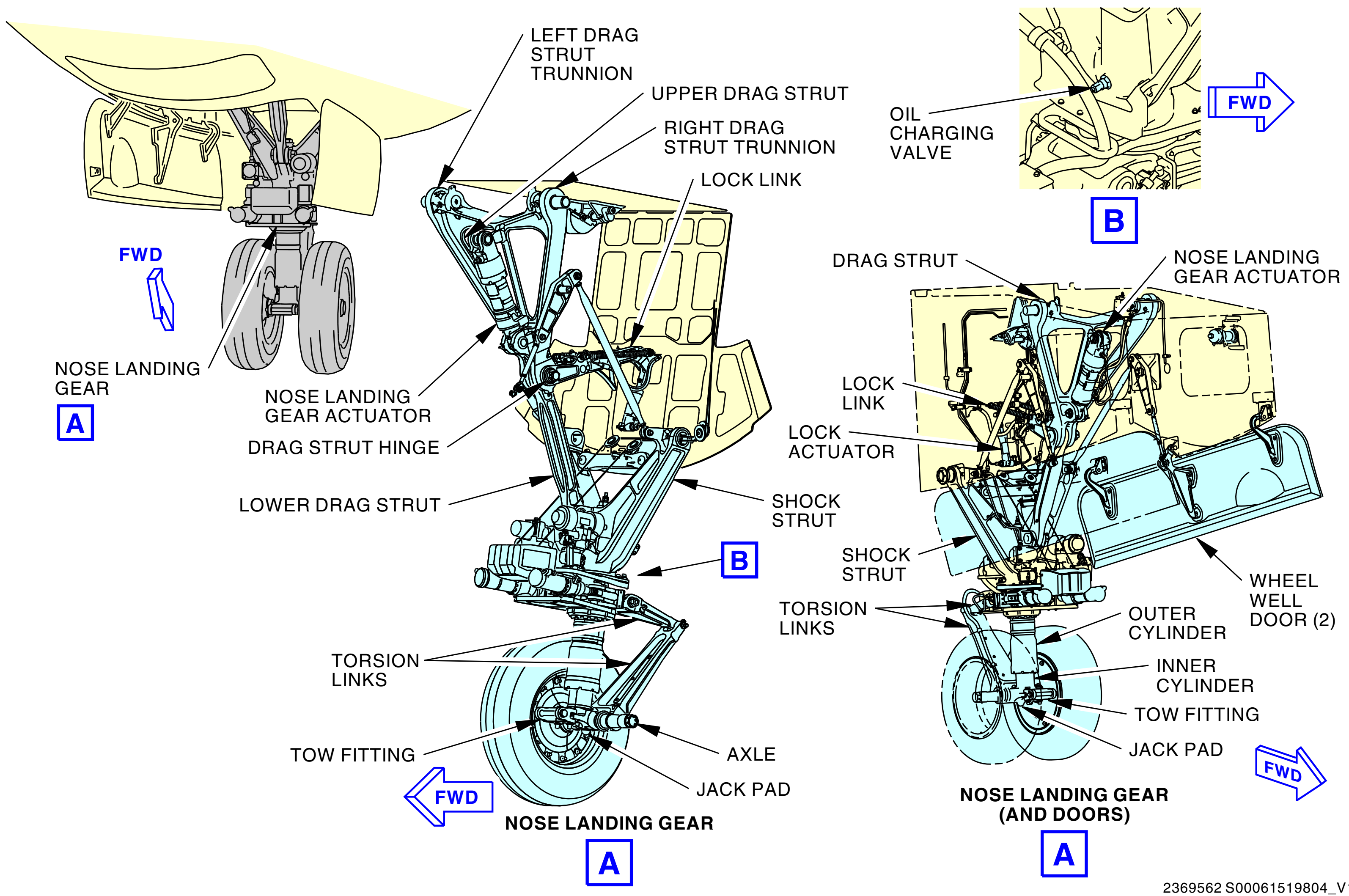
Tow Fitting

A tow fitting is between the nose landing gear tires.

NLG Doors

Two doors aerodynamically seal the nose landing gear wheel well to decrease drag. The doors attach to the outboard edges of the nose landing gear wheel well. The doors connect to the shock strut and move mechanically when the nose landing gear extends or retracts.

NOSE LANDING GEAR AND DOORS - GENERAL DESCRIPTION



NOSE LANDING GEAR AND DOORS - GENERAL DESCRIPTION

NOSE LANDING GEAR AND DOORS - SHOCK STRUT SEALS

Purpose

The nose landing gear shock strut is an air-oil shock absorber. It has an inner cylinder that moves in an outer cylinder. The seals provide an air-oil seal between the two cylinders.

Location

A static and a dynamic seal between the inner and outer cylinders keep the mixture of nitrogen and hydraulic fluid in the shock strut.

Physical Description

The seals are an elastomer type seal.

Functional Description

There are spare static and dynamic seals in the shock strut. These spare seals let you remove and replace defective seals without removal of the inner cylinder.

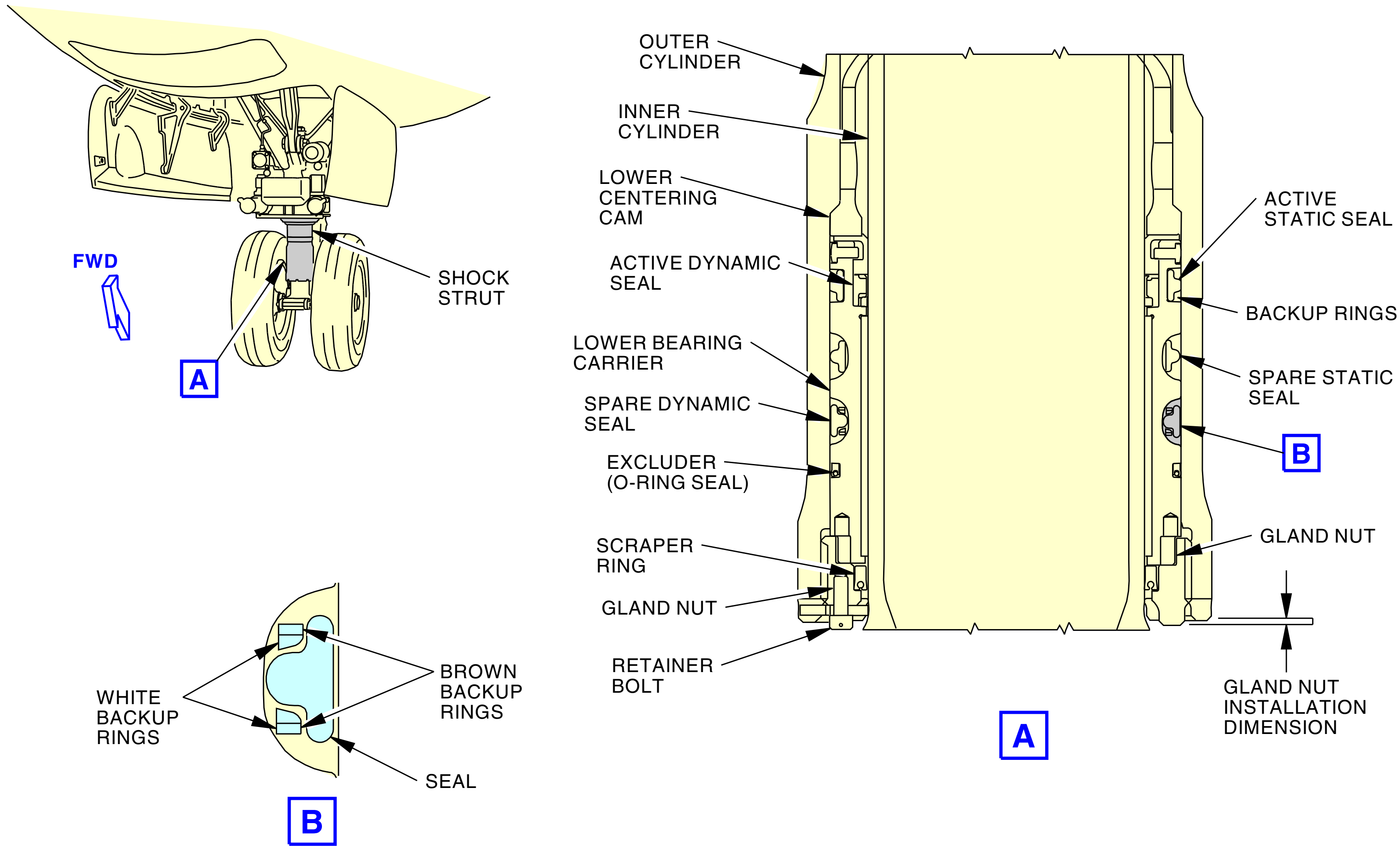
The upper bearing carrier (not shown) and the lower bearing carrier hold the active and spare seals.

The excluder ring (O-ring) seal protects the spare seals from external contamination and ozone damage.

The scraper ring protects the inner and outer strut components from unwanted material.

The gland nut and retainer bolt hold the lower bearing carrier.

NOSE LANDING GEAR AND DOORS - SHOCK STRUT SEALS



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NOSE LANDING GEAR AND DOORS - SHOCK STRUT SEALS

NOSE LANDING GEAR AND DOORS - NOSE LANDING GEAR DOORS

Purpose

Two nose landing gear doors aerodynamically seal the nose gear wheel well to decrease drag.

Location

The doors attach to the outboard edges of the nose landing gear wheel well with hinges.

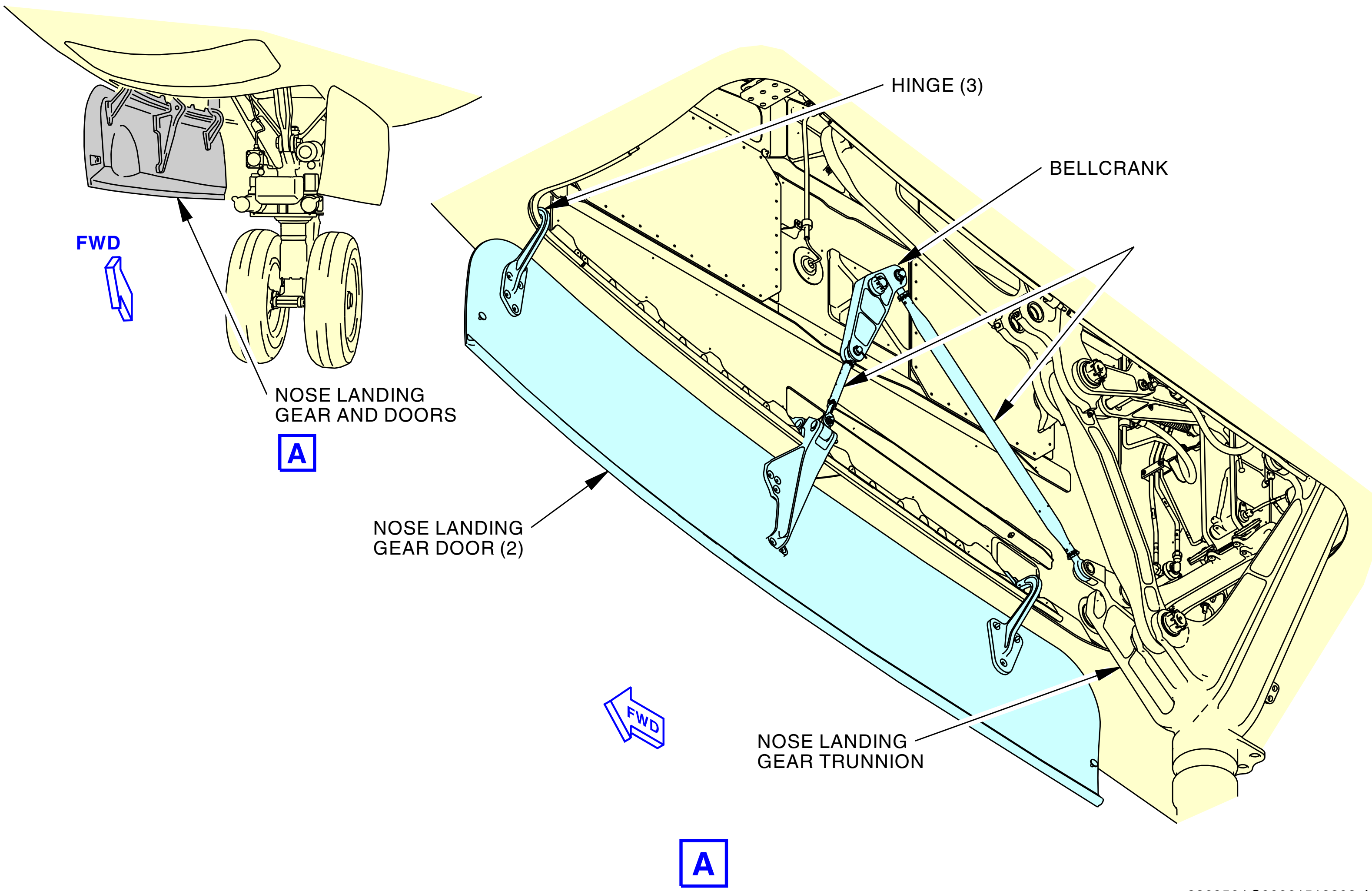
Physical Description

The nose landing gear doors are made of composite materials.

Functional Description

Control rods and bellcranks connected to the top of the shock strut move the doors mechanically with the nose landing gear during extension and retraction. When the gear extends, the doors open. When the gear retracts, the doors close.

NOSE LANDING GEAR AND DOORS - NOSE LANDING GEAR DOORS



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NOSE LANDING GEAR AND DOORS - NOSE LANDING GEAR DOORS

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LANDING GEAR EXTENSION AND RETRACTION - GENERAL DESCRIPTION

General

These are the sub-systems of the landing gear extension and retraction system:

- Landing gear control system
- Main landing gear extension and retraction
- Nose landing gear extension and retraction
- Main landing gear manual extension system
- Nose landing gear manual extension system.

The landing gear control system controls the main and nose landing gear extension and retraction. The landing gear control system also provides normal or alternate hydraulic pressure to these systems:

- Main landing gear shimmy damper
- Gear retract brake system.

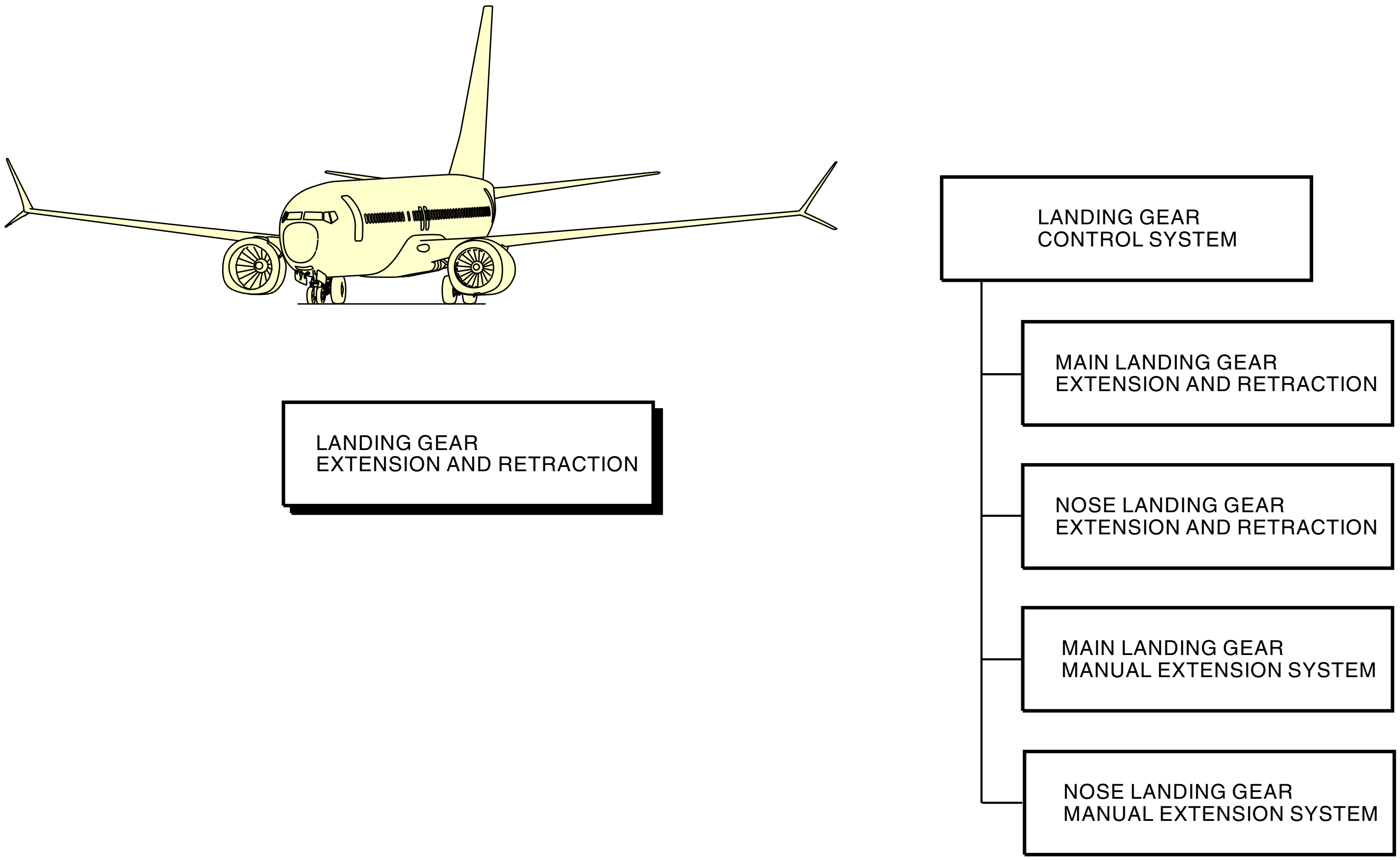
The main landing gear extension and retraction system controls both main landing gear.

The nose landing gear extension and retraction system controls the nose landing gear and provides normal and alternate hydraulic pressure to the nose wheel steering system.

The main landing gear manual extension system controls the manual extension of the main landing gear when hydraulic pressure is not a available.

The nose landing gear manual extension system controls the manual extension of the nose landing gear when hydraulic pressure is not available.

LANDING GEAR EXTENSION AND RETRACTION - GENERAL DESCRIPTION



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LANDING GEAR EXTENSION AND RETRACTION - GENERAL DESCRIPTION

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LANDING GEAR CONTROL SYSTEM - GENERAL DESCRIPTION

Purpose

The landing gear control system controls the extension and retraction of the main and nose landing gears.

The landing gear control system also provides normal or alternate hydraulic pressure to these systems:

- Main landing gear shimmy damper
- Gear retract brake system.

See the Main Landing Gear and Doors section for more information about the main landing gear shimmy damper. (SECTION 32-10)

See the Wheels and Brakes section for more information about the gear retract brake system. (SECTION 32-41)

Components

The landing gear control system has these components:

- Control lever assembly
- Selector valve
- Transfer valve.

General Description

Hydraulic system A usually supplies pressure to the landing gear extension and retraction. Hydraulic system B supplies pressure for retraction only through the landing gear transfer valve. The landing gear transfer valve receives electrical signals from the proximity switch electronics unit (PSEU). The landing gear transfer valve changes the pressure source of the landing gear from hydraulic system A to hydraulic system B when these conditions occur:

- Airplane in the air
- Landing gear lever not down
- One main landing gear not up
- Left engine N2 speed less than 50%
- Hydraulic system B pressure supplied to valve.

The landing gear control lever is used to command landing gear extension and retraction. Movement of the landing gear lever provides an electrical signal to the landing gear selector valve.

The selector valve also gets an electrical input from the manual extension system. This operates a bypass valve in the selector valve to connect the landing gear retraction to the hydraulic system return. This lets the manual extension system extend the landing gear.

See the Air/Ground System section for more information about the proximity switch electronics unit (PSEU). (SECTION 32-09)

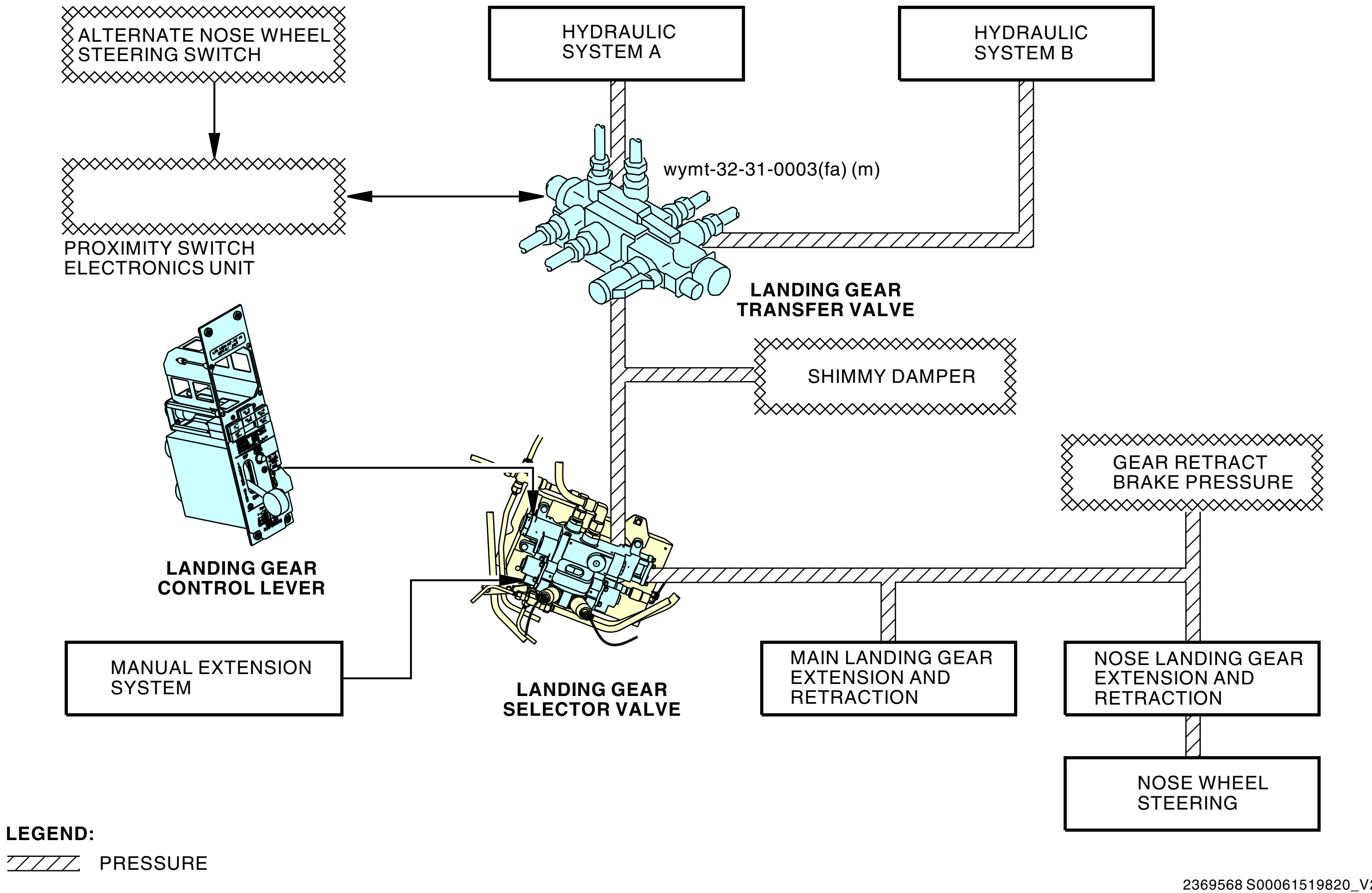
Nose Wheel Steering

The pressure for nose wheel steering comes from the nose landing gear extension pressure only. Hydraulic system A normally supplies pressure to the nose gear steering through the landing gear control system.

When you move the alternate nose wheel steering switch to the alternate position, the landing gear transfer valve moves to the alternate position. The landing gear transfer valve moves the pressure source, for the landing gear retraction and the nose wheel steering, from hydraulic system A to hydraulic system B.

See the Nose Wheel Steering section for more information about the nose wheel steering. (SECTION 32-51)

LANDING GEAR CONTROL SYSTEM - GENERAL DESCRIPTION



LANDING GEAR CONTROL SYSTEM - GENERAL DESCRIPTION

LANDING GEAR CONTROL SYSTEM - LEVER ASSEMBLY

Purpose

The landing gear control lever operates the landing gear selector valve with an electrical signal through the UP and DN landing gear lever position switches.

Location

The landing gear control lever is on the P2 center forward panel in the flight compartment.

Physical Description

The control lever assembly has these components:

- Control lever
- Position switch (4)
- Lock mechanism
- Lever lock solenoid.

Functional Description

The landing gear control lever has two positions with detents:

- UP
- DOWN.

You must first pull the control lever out before you can move the lever.

The control lever assembly has a lever lock mechanism operated by a lever lock solenoid. The lever lock prevents accidental movement of the landing gear lever to the up position when the airplane is on the ground. When the airplane takes off, the solenoid gets electrical power and retracts. This turns the lever lock mechanism to the unlocked position.

The landing gear control lever assembly has four control lever position switches. Two down position switches send signals when the lever moves to the down position. Two up position switches send signals when the lever moves to the up position.

The auto-off feature de-energizes the UP command 10 seconds after all gear are up and locked which depressurizes the landing gear hydraulic circuit.

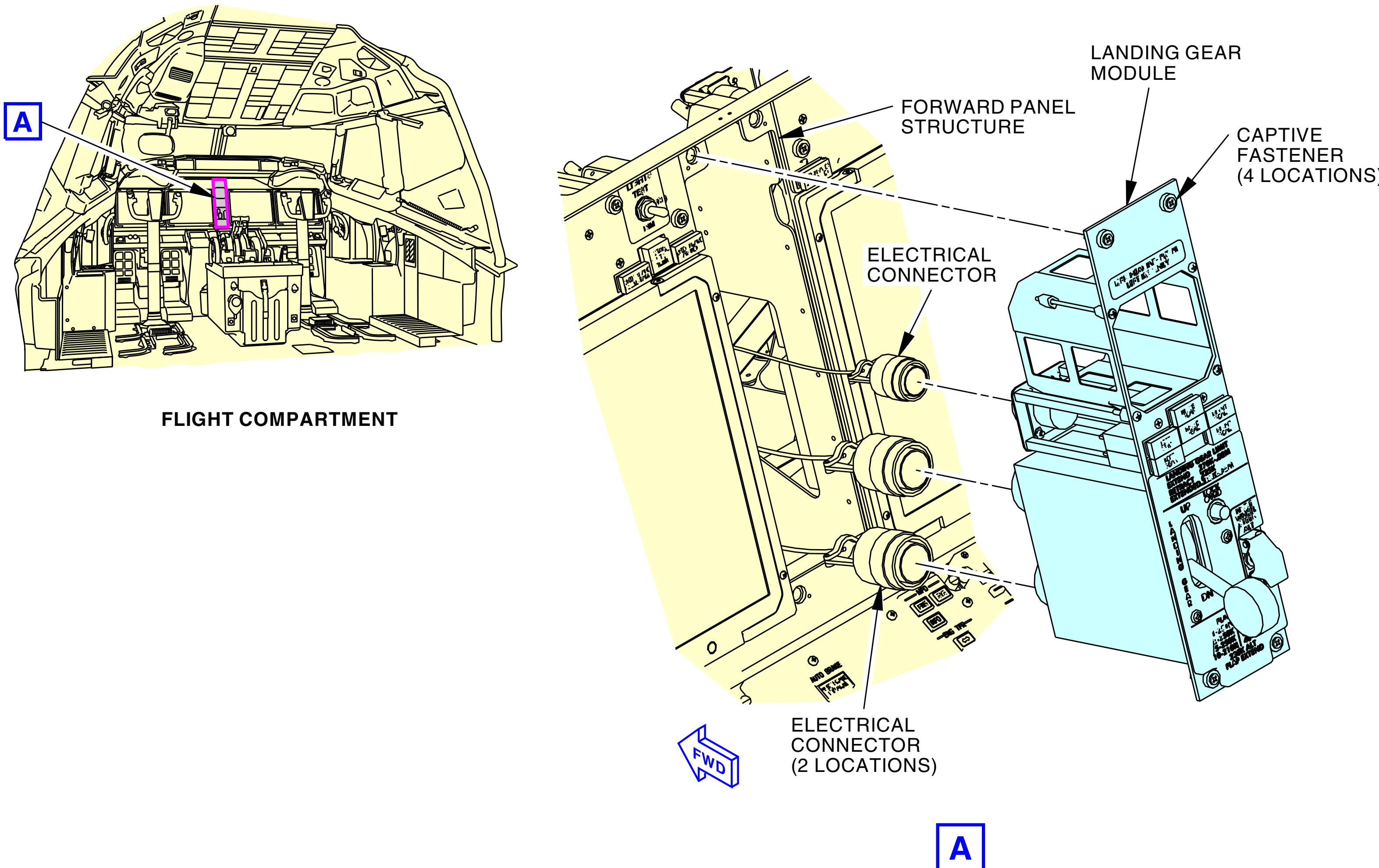
When you put the landing gear lever in the down position, the down position switches move to the closed position. This sends signals to the landing gear position indication and warning system. The position indication system uses these signals to operate the red landing gear position lights.

When you put the landing gear lever in the up position, the up position switches move to the closed position. This sends signals to the antiskid system. The antiskid system uses these signals to inhibit antiskid operation during gear retract braking.

See the Landing Gear Position Indicating And Warning System Section for more information. (SECTION 32-61)

See the antiskid/autobrake system section for more information about the antiskid system. (SECTION 32-42)

LANDING GEAR CONTROL SYSTEM - LEVER ASSEMBLY



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LANDING GEAR CONTROL SYSTEM - LEVER ASSEMBLY

LANDING GEAR CONTROL SYSTEM - SELECTOR VALVE

Purpose

The landing gear selector valve directs hydraulic pressure from the transfer valve to extend and retract the main landing gear and the nose landing gear.

Location

The selector valve is on the ceiling in the left main landing gear wheel well.

Physical Description

The landing gear selector valve is a three-position valve and has these components:

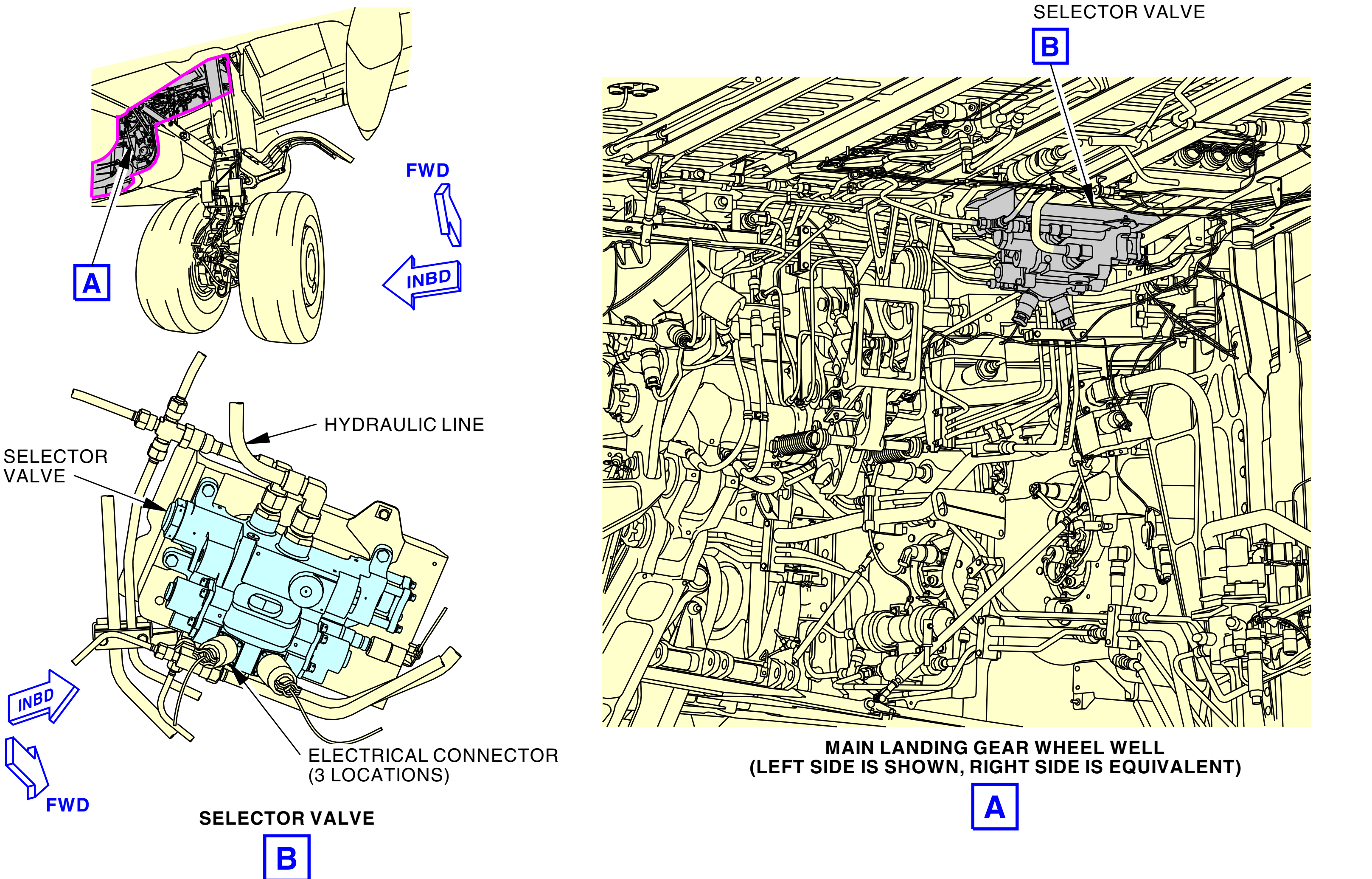
- Slide valve
- Manual extend solenoid valve
- Bypass valve.

Functional Description

The landing gear selector-bypass valve is located on the left main gear wheel well upper bulkhead. The selector-bypass valve ports hydraulic pressure to the normal landing gear actuation system to retract and extend the landing gear. The landing gear selector-bypass valve is a pressure operated solenoid controlled three position valve with “down,” “off,” and “up” positions. Normally with no commands to the UP and DOWN solenoids, the valve is spring and pressure centered to the off position. If both the UP and DOWN solenoids are energized or if the normal actuation system pressure fails the valve is spring centered to the off position.

The manual extension system supplies electrical signals to a solenoid valve in the selector valve. The solenoid valve controls hydraulic pressure to a pressure operated bypass valve. When the bypass valve is in the bypass position, landing gear up pressure is ported around the slide valve to return. This prevents a hydraulic lock in the landing gear system if the slide valve jams.

LANDING GEAR CONTROL SYSTEM - SELECTOR VALVE



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LANDING GEAR CONTROL SYSTEM - SELECTOR VALVE

LANDING GEAR CONTROL SYSTEM - TRANSFER VALVE

Purpose

The landing gear transfer valve changes the pressure supply for landing gear retraction from hydraulic system A to hydraulic system B.

Location

The landing gear transfer valve is in the main landing gear wheel well on the forward end of the keel beam.

Physical Description

The transfer valve is a two-position, hydraulic or solenoid operated valve and has these components:

- Slide valve
- Solenoid valve
- Position switch.

Functional Description

The landing gear transfer valve gets signals from the PSEU for automatic and manual operation.

The landing gear transfer valve moves automatically to the alternate position when all of these conditions occur:

- Airplane in the air
- Landing gear lever not down
- One main landing gear not up
- Left engine N2 speed less than 50%
- Hydraulic system B pressure supplied to valve.

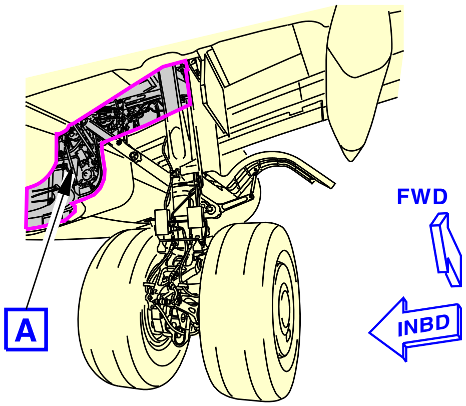
The landing gear transfer valve operates manually when all of these conditions occur:

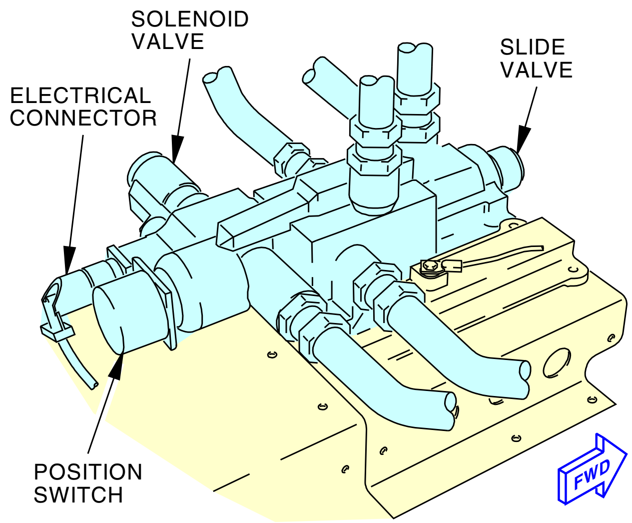
- Alternate nose wheel steering switch is moved to the alternate position
- Normal quantity in system B reservoir
- Nose air/ground system in ground mode.

The position switch on the landing gear transfer valve sends a signal to the PSEU when the valve moves to the alternate position.

See the Air/Ground System for more information about the PSEU. (SECTION 32-09)

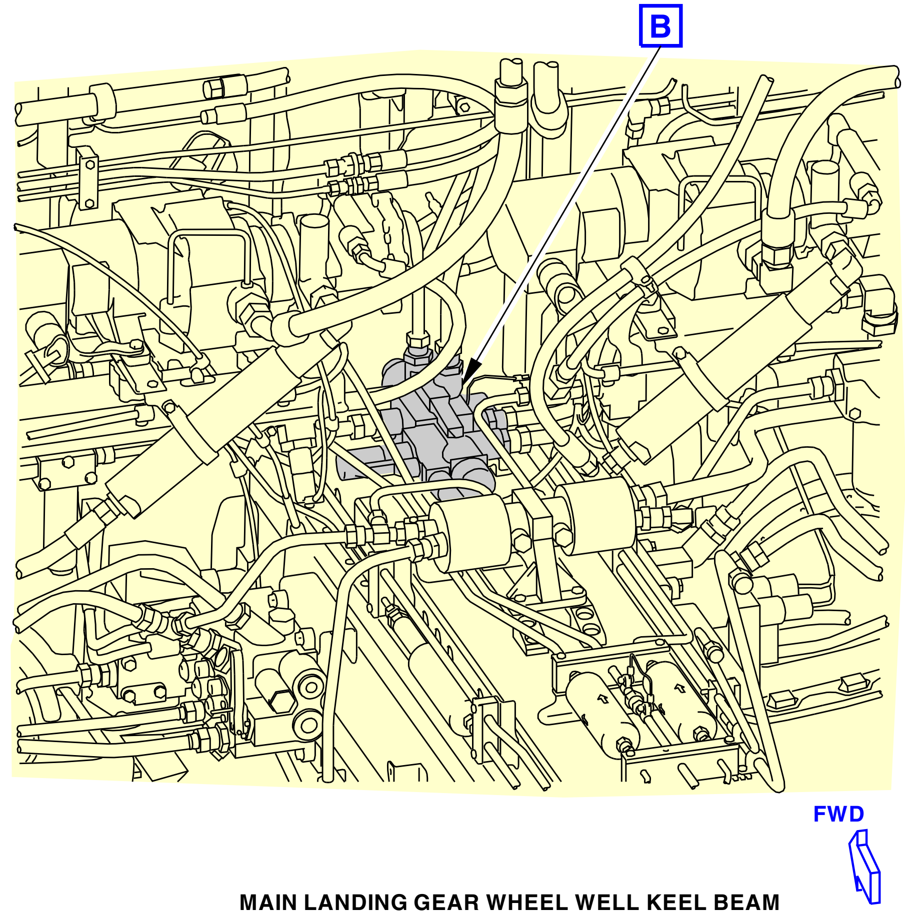
LANDING GEAR CONTROL SYSTEM - TRANSFER VALVE





LANDING GEAR TRANSFER VALVE

B



MAIN LANDING GEAR WHEEL WELL KEEL BEAM

A

2369572 S00061519828_V1

LANDING GEAR CONTROL SYSTEM - TRANSFER VALVE

LANDING GEAR CONTROL SYSTEM - LEVER LOCK - FUNCTIONAL DESCRIPTION - ELECTRICAL

General

The lever lock solenoid prevents accidental movement of the landing gear control lever to the UP position when the airplane is on the ground.

Functional Description

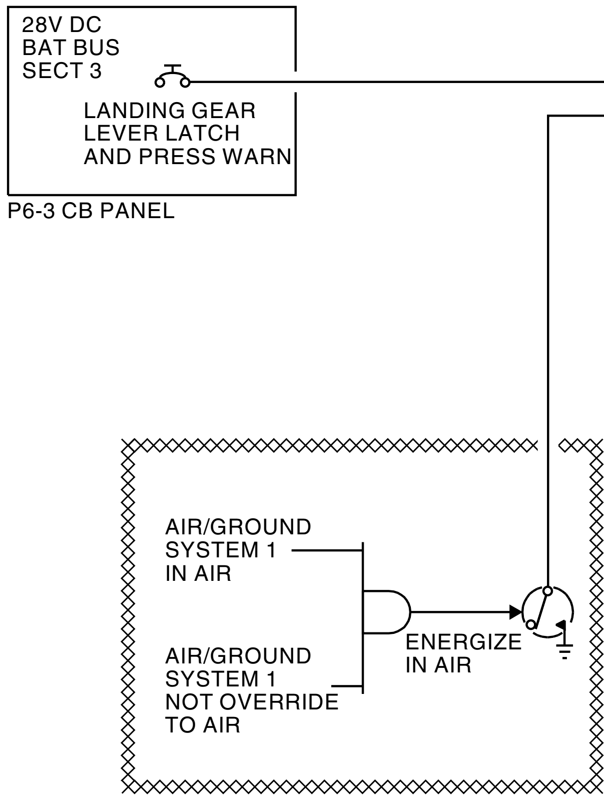
The landing gear control lever is locked out of the UP position by a mechanical lever lock. 28v dc power from the battery bus goes through the lever lock solenoid and completes a ground at the proximity switch electronics unit when these conditions are true:

- Ground spoiler interlock valve closed
- Air/ground system 1 in air mode
- Air/ground system 1 not override to air (from PSEU).

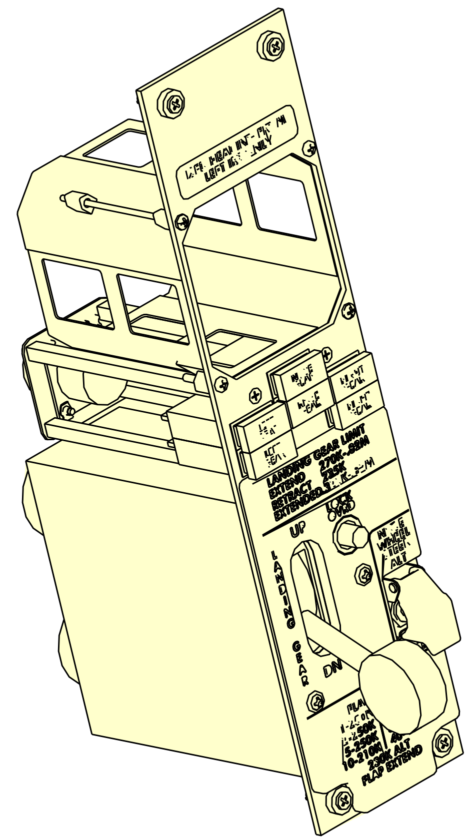
When the lever lock solenoid energizes, it retracts. This moves the lever lock to the not locked position. This lets the pilot move the landing gear control lever to the UP position.

If the solenoid fails to unlock the lever after takeoff, the pilot pushes the lever lock override button next to the control lever and moves the control lever to the UP position.

LANDING GEAR CONTROL SYSTEM - LEVER LOCK - FUNCTIONAL DESCRIPTION - ELECTRICAL



PSEU (E11)



LANDING GEAR CONTROL
LEVER ASSEMBLY

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LANDING GEAR CONTROL SYSTEM - LEVER LOCK - FUNCTIONAL DESCRIPTION - ELECTRICAL

LANDING GEAR CONTROL SYSTEM - LANDING GEAR TRANSFER VALVE - FUNCTIONAL DESCRIPTION - ELECTRICAL

General

The landing gear transfer valve changes the landing gear pressure supply from system A to system B automatically or manually.

Automatic Operation

The landing gear transfer valve automatically moves to the alternate position when all of these conditions occur:

- Airplane in the air
- Landing gear lever not down
- One main landing gear not up
- Left engine N2 speed less than 50%
- Hydraulic system B pressure to valve.

The air/ground systems in the proximity switch electronics unit (PSEU) supply air/ground information. The landing gear indication function of the PSEU supplies main landing gear position and landing gear control lever position. The left engine running relay supplies a signal when the engine speed decreases to less than 50%. Two circuit breakers supply 28v dc power.

The PSEU processes the inputs and supplies two signals to the coils on the solenoid valve on the landing gear transfer valve.

The position switch on the transfer valve sends a ground to the PSEU.

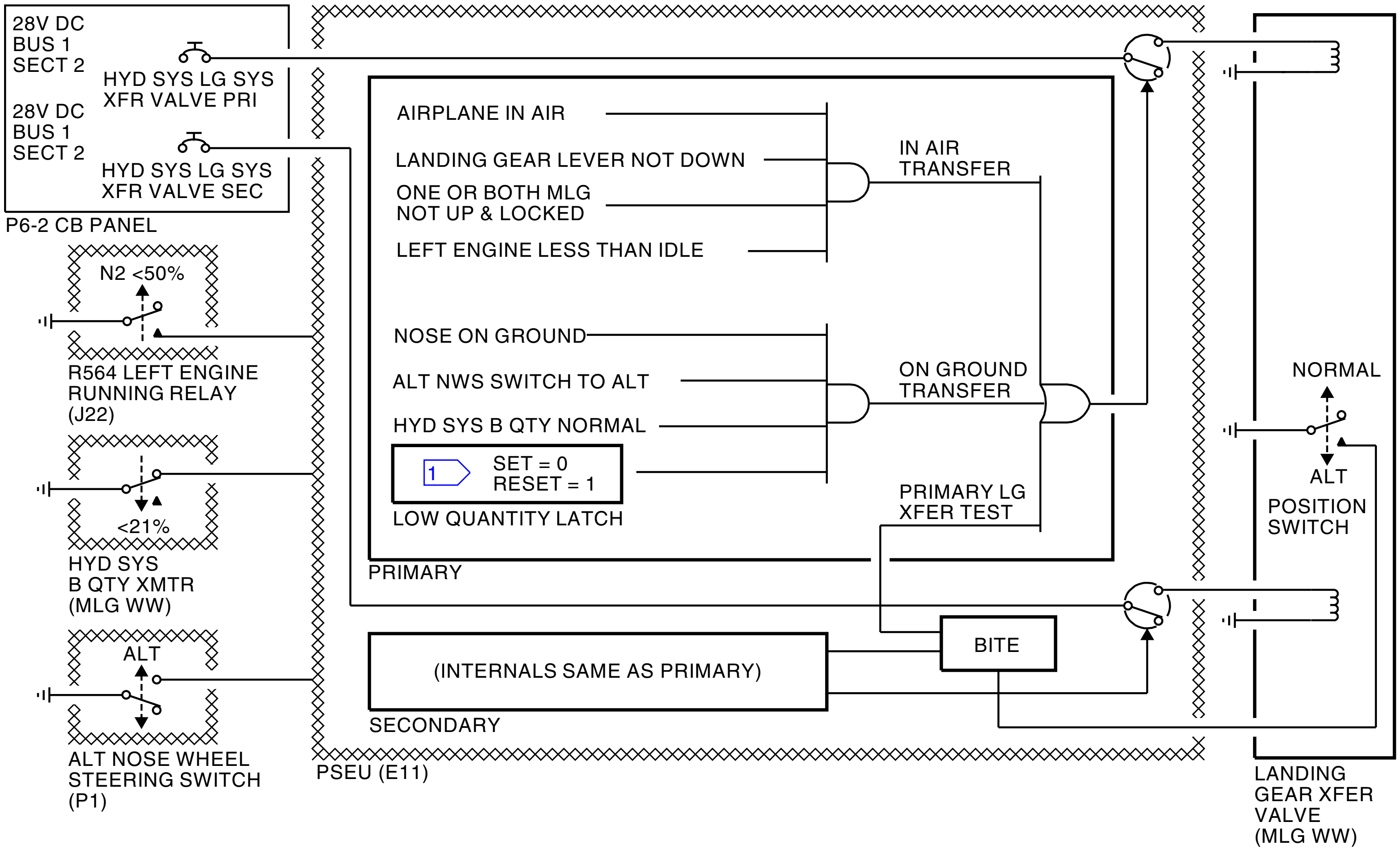
Manual Operation

When the airplane is on the ground and with normal quantity in the hydraulic system B reservoir, the landing gear transfer valve moves to the alternate position when you move the alternate nose wheel steering switch on the P1 panel to the ALT position.

The system B low quantity latch prevents operation of the landing gear transfer valve when the alternate nose wheel steering switch is in the alternate position, and the system B hydraulic quantity momentarily decreases to less than 21 percent. The transfer valve moves to the normal position if the latch sets during alternate operation.

The low quantity latch stops intermittent operation of the transfer valve if the system B quantity increases more than and decreases less than 21 percent again and again. The latch sets when the nose air/ground system is in the ground mode and the system B quantity is low. The latch resets when the alternate nose wheel steering switch is in the normal position.

LANDING GEAR CONTROL SYSTEM - LANDING GEAR TRANSFER VALVE - FUNCTIONAL DESCRIPTION - ELECTRICAL



1 SET: NOSE ON GROUND, HYD SYS B QTY <21%,
AND ALT NWS SWITCH TO ALT
RESET: ALT NWS SW TO NORMAL

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LANDING GEAR CONTROL SYSTEM - LANDING GEAR TRANSFER VALVE - FUNCTIONAL DESCRIPTION - ELECTRICAL

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LANDING GEAR CONTROL SYSTEM - FUNCTIONAL DESCRIPTION - HYDRAULIC

General

Hydraulic system A normally supplies pressure for landing gear extension and retraction. Hydraulic system B supplies pressure for retraction only, through the landing gear transfer valve.

Landing Gear Transfer Valve

The landing gear transfer valve has these components:

- Solenoid valve
- Slide valve
- Position switch.

When the solenoid valve does not receive a signal, pressure from hydraulic system A moves the slide valve to the normal position. In the normal position, the landing gear transfer valve sends hydraulic system A pressure to the landing gear selector valve.

When the solenoid valve receives a signal from the proximity switch electronics unit (PSEU), the solenoid valve opens. This sends hydraulic system B pressure to move the slide valve to the alternate position. In the alternate position, the landing gear transfer valve sends hydraulic system B pressure to the landing gear selector valve.

When the slide valve moves to the alternate position, the position switch on the landing gear transfer valve closes. This sends a ground to the built-in-test equipment (BITE) of the PSEU.

See the Air/Ground System Section for more information about the PSEU. (SECTION 32-09)

Landing Gear Selector/Bypass Valve

The landing gear lever operates the landing gear selector valve. These are the three positions of the landing gear selector valve:

- UP (retract)
- OFF
- DOWN (extend).

The landing gear selector valve has these components:

- Slide valve
- Up solenoid operated valve
- Up solenoid (2)
- Down solenoid operated valve
- Down solenoid (2)
- Alternate extend solenoid valve
- Bypass valve.

When you move the landing gear control lever to the DN position, 28v dc goes to the down solenoids. This makes the slide valve move to the down position. Down pressure goes to the landing gear components for landing gear extension. Down pressure also moves the bypass valve to the normal position.

When the landing gear control lever moves to the UP position, power is removed from the down solenoids. The PSEU sends 28v dc to the up solenoids. This makes the slide valve move to the up position. Up pressure goes through the bypass valve to the landing gear components for landing gear retraction.

Ten seconds after all gear are up and locked, the PSEU removes power from the up solenoids. Spring pressure and hydraulic pressure at each end of the slide valve cause the slide valve to move to the off position. This is called auto-off. This auto-off function isolates the gear circuits from supply pressure during cruise.

The alternate extend solenoid valve has a normal position and an alternate position. When the coil on the alternate extend solenoid valve does not receive a signal, a spring moves the alternate extend solenoid valve to the normal position.

The bypass valve has a normal and a bypass position. Pressure from the slide valve or the manual extend solenoid valve operates the bypass valve. During normal landing gear operation, the bypass valve moves to the normal position.

The bypass valve has a normal and a bypass position. Pressure from the slide valve or the alternate extend solenoid valve operates the bypass valve. During normal landing gear operation, the bypass valve moves to the normal position.

When you open the manual extension access door, the alternate extend solenoid valve energizes. The alternate extend solenoid valve moves to the alternate position. When the alternate extend solenoid valve moves to the alternate position, pressure goes to move the bypass valve to the bypass position.

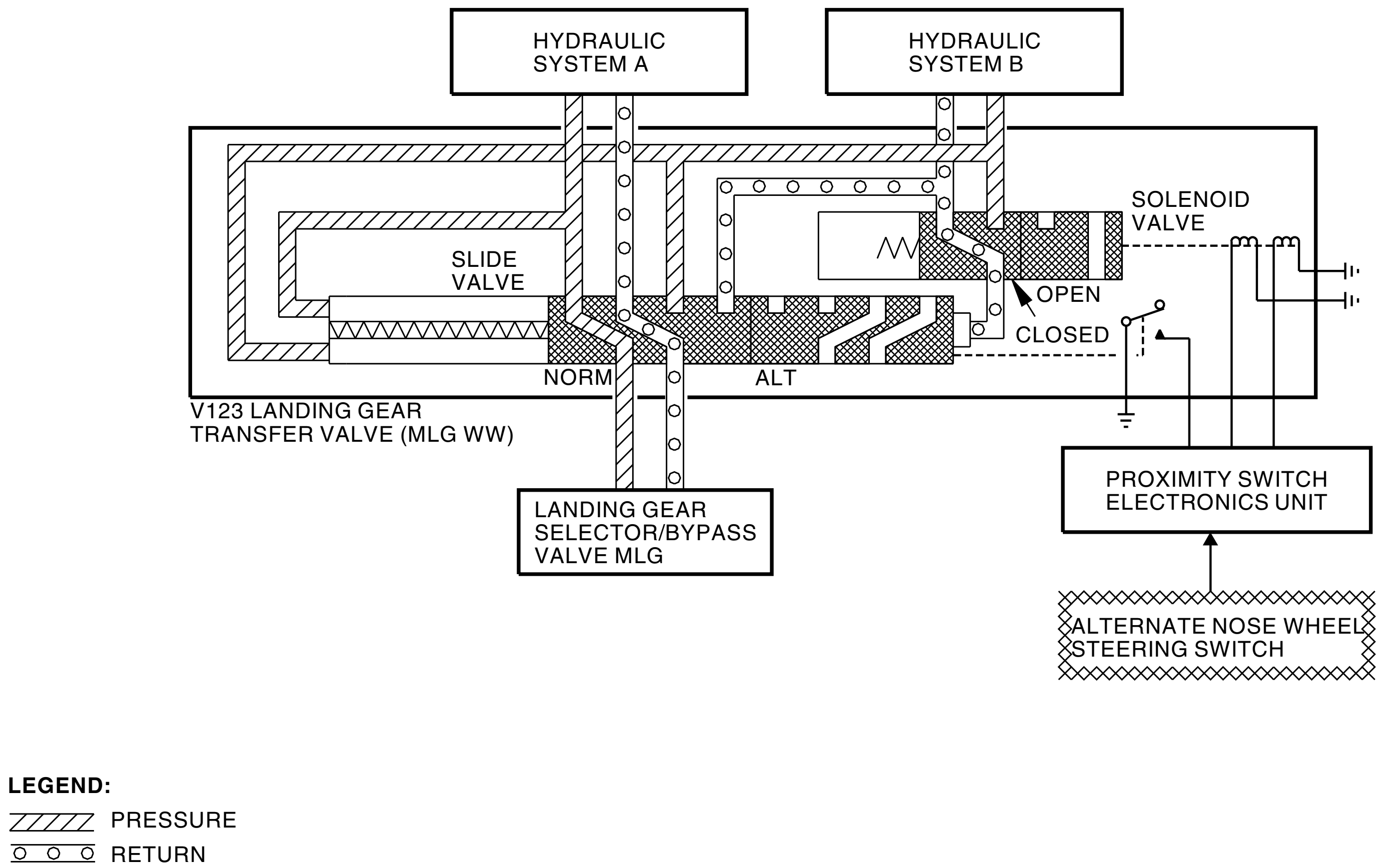
When the bypass valve moves to the bypass position, up pressure does not go to the landing gear. Also, the bypass valve connects the landing gear retraction up pressure lines to the hydraulic system return. This lets the manual extension system extend the gear if the slide valve of the selector valve jams in the up position.

Nose Wheel Steering

The pressure for nose wheel steering comes from the nose landing gear extension pressure only. Hydraulic system A normally supplies pressure to the nose wheel steering system.

When you move the alternate nose wheel steering switch on the P1 panel to the ALT position, the landing gear transfer valve moves to the alternate position. When you operate the alternate nose wheel steering switch, the airplane must be on the ground and there must be normal quantity in the hydraulic system B reservoir.

See the nose wheel steering system section for more information about the alternate nose wheel steering switch. (SECTION 32-51)



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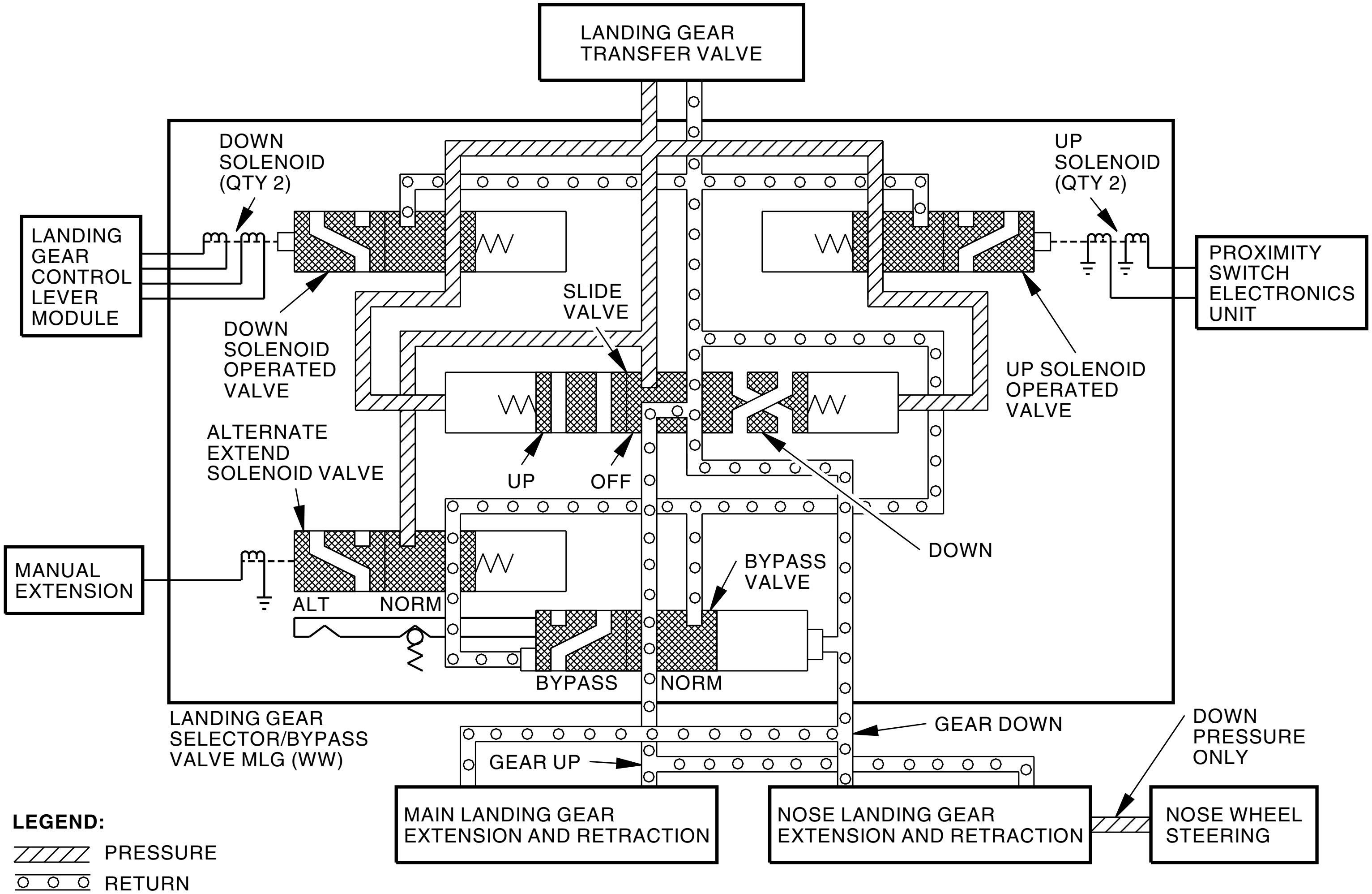
LANDING GEAR CONTROL SYSTEM - FUNCTIONAL DESCRIPTION - HYDRAULIC

LANDING GEAR CONTROL SYSTEM - FUNCTIONAL DESCRIPTION - HYDRAULIC



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LANDING GEAR CONTROL SYSTEM - FUNCTIONAL DESCRIPTION - HYDRAULIC

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MLG EXTENSION AND RETRACTION - GENERAL DESCRIPTION

General

Hydraulic system A normally supplies pressure to extend and retract the main landing gear. Hydraulic system B supplies alternate pressure for retraction only. The landing gear transfer valve controls the pressure source (hydraulic system A or hydraulic system B) to supply the main landing gear.

The shimmy damper decreases main landing gear shimmy. The shimmy damper is connected to the return line between the landing gear selector valve and the landing gear transfer valve.

See the MLG and Doors section for more information about the shimmy damper. (SECTION 32-10)

The landing gear selector valve supplies up or down pressure to retract or extend the main landing gear. The landing gear lever controls the landing gear selector valve.

WARNING: MAKE SURE THAT ALL PERSONS AND EQUIPMENT ARE CLEAR OF THE MAIN LANDING GEAR. FAST MOVEMENT OF THE MAIN LANDING GEAR CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

Up pressure goes to the alternate and gear retract brake system. This stops wheel rotation during main landing gear retraction.

See the Wheels and Brakes section for more information about the gear retract brake system. (SECTION 32-41)

Components

These are the main landing gear extension and retraction components:

- Main landing gear actuator (2)
- Uplock mechanism (2) and uplock actuator (2)
- Downlock actuator (2)
- Transfer cylinder (2)
- Frangible fitting (2)
- Fuse (2).

MLG Actuator

The main landing gear actuator moves the gear up and down.

Uplock Mechanism and Actuator

The uplock actuator unlocks the uplock mechanism during extension.

Downlock Mechanism and Actuator

The downlock actuator locks the main landing gear during extension and unlocks the main landing gear during retraction.

Transfer Cylinder

The transfer cylinder gives a time delay to permit the main landing gear to unlock before the main gear actuator moves the gear.

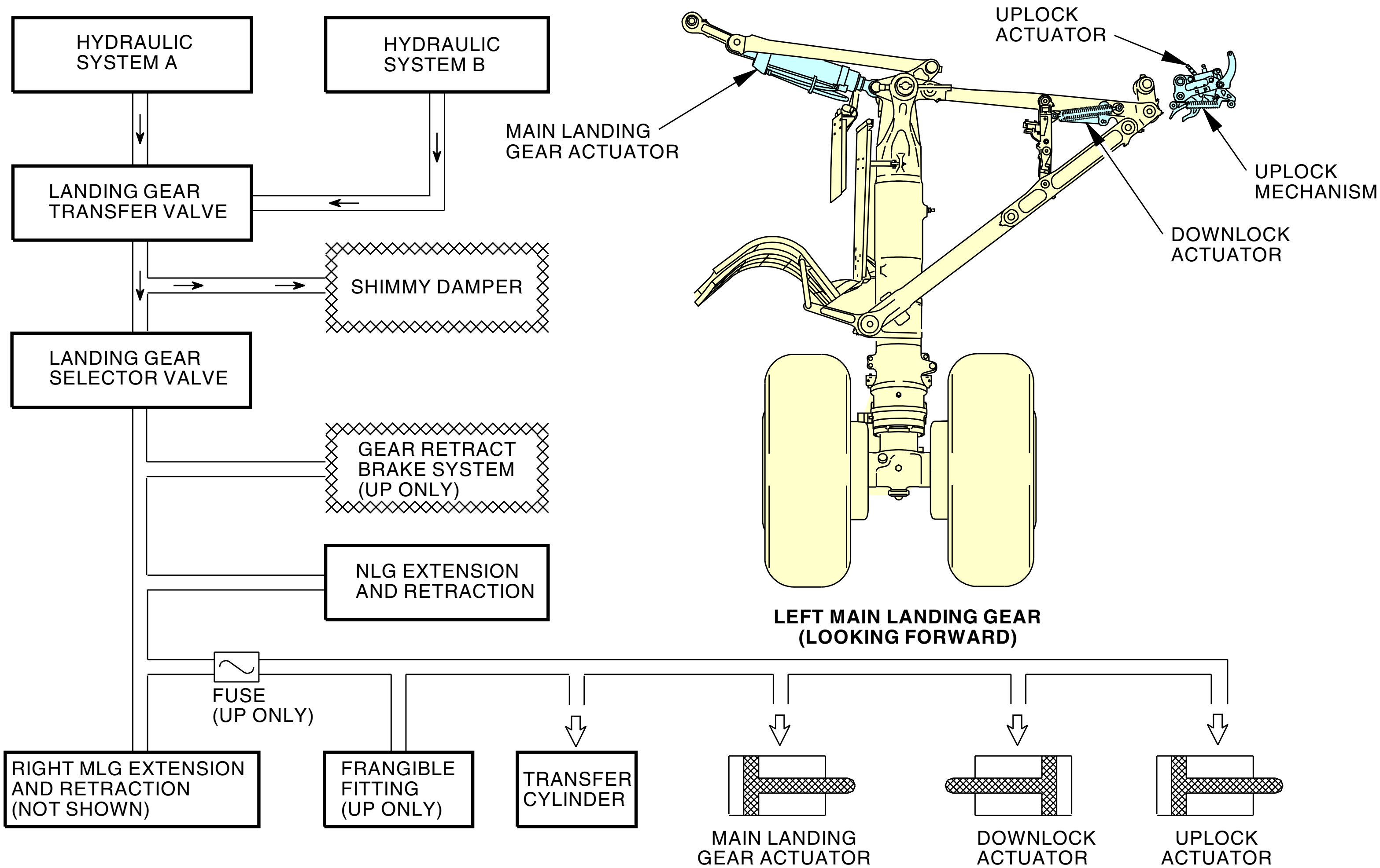
Frangible Fitting

The frangible fitting(s) removes up pressure from the main landing gear actuator when a damaged, spinning tire moves into the main landing gear wheel well. This prevents damage to components in the wheel well.

Fuse

The fuse prevents hydraulic system fluid loss when the frangible fitting(s) operates.

MLG EXTENSION AND RETRACTION - GENERAL DESCRIPTION



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MLG EXTENSION AND RETRACTION - GENERAL DESCRIPTION

MLG EXTENSION AND RETRACTION - OPERATION

Retraction

This is the retraction sequence for the main landing gear:

- Landing gear control lever moved to UP
- Transfer cylinder strokes
- Downlock actuator extends
- Downlock mechanism unlocks
- Main landing gear actuator extends
- Main landing gear retracts
- Uplock roller moves into uplock mechanism
- Uplock mechanism locks
- The PSEU provides an auto-off function by de-energizing the UP command ten seconds after all gears are up and locked.

When the landing gear control lever is in the UP position, hydraulic pressure pressurizes the MLG up lines through the selector valve to the MLG transfer cylinders and MLG downlock actuators. The transfer cylinders stroke. This delays full pressurization to the MLG actuators until the downlock actuators unlock the downlock mechanism. After the downlocks unlock, pressure increases in the head end of the MLG actuators and they extend to retract the landing gear.

As the landing gear gets to the up position, the restrictor decreases the flow of fluid that goes into the head end of the retract actuators. The roller on the MLG strut touches the uplock hook and turns the hook and uplock mechanism to the locked position. This locks the MLG in the retracted position.

PSEU System 1 and 2 provide an auto-off function by de-energizing the UP command ten seconds after all gears are up and locked..

Extension

This is the extension sequence for the main landing gear:

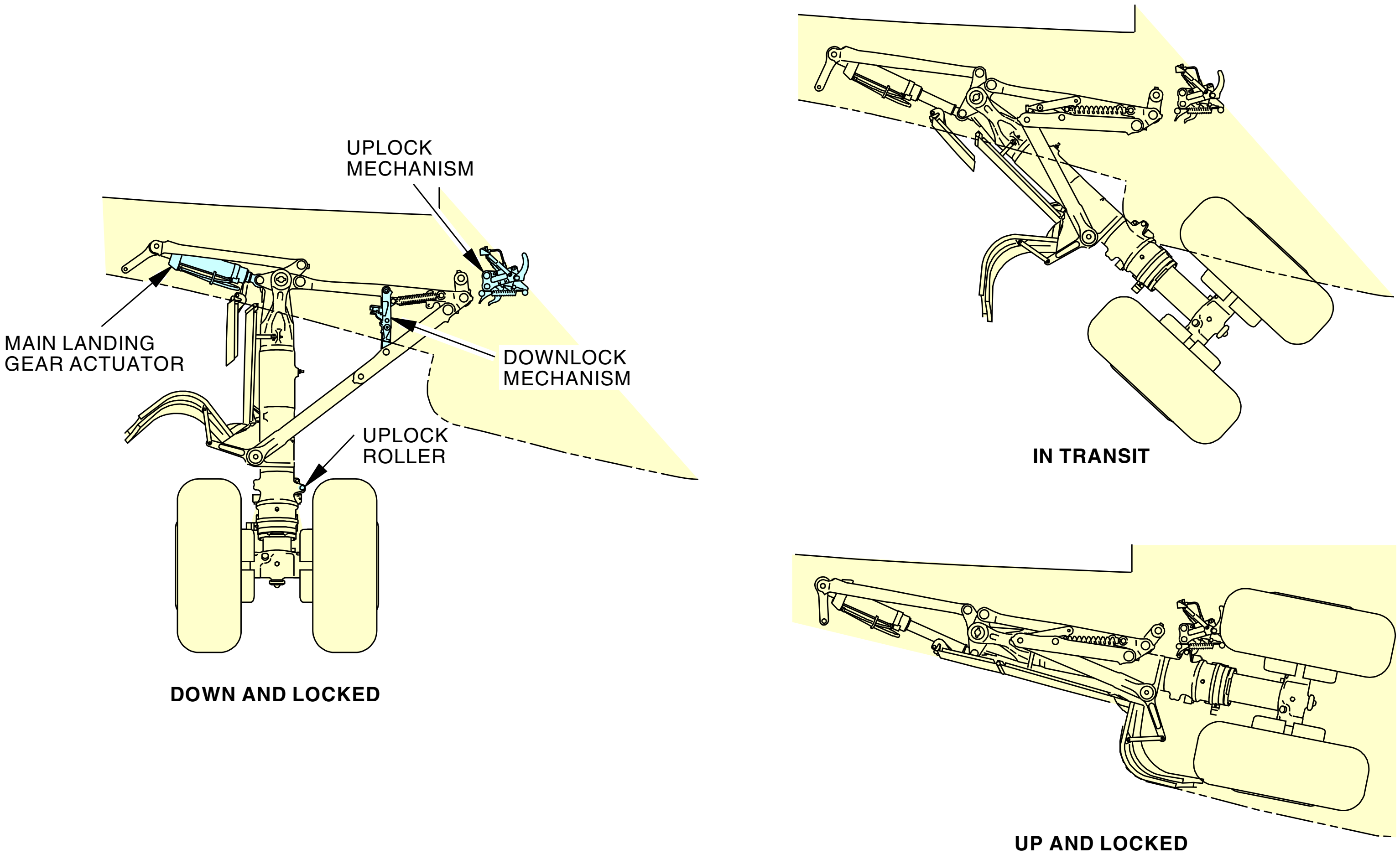
- Landing gear control lever moved to DOWN
- Uplock actuator retracts
- Uplock mechanism unlocks
- Main landing gear actuator retracts
- Main landing gear extends
- Downlock actuator retracts
- Downlock mechanism locks.

When the landing gear control lever is in the DOWN position, hydraulic pressure pressurizes the MLG down lines through the selector valve to the MLG transfer cylinders and MLG downlock actuators. The transfer cylinders stroke. This delays full pressurization to the MLG actuators until the uplock actuators unlock the uplock mechanism. After the uplocks unlock, pressure increases in the rod-end of the MLG actuators and they retract. The landing gear extends by actuator force, landing gear weight, and airloads.

As the landing gear gets to the down position, the restrictor decreases the flow of fluid that leaves the head-end of the retract actuators. The downlock actuators and downlock springs move the downlock mechanism to the locked position to lock the MLG in the extended position.

When the landing gear lever is in the DOWN position, the downlock actuators, retract actuators, and transfer cylinders remain pressurized.

MLG EXTENSION AND RETRACTION - OPERATION



MLG EXTENSION AND RETRACTION - OPERATION

MLG EXTENSION AND RETRACTION - MAIN LANDING GEAR ACTUATOR

Purpose

The main landing gear actuator with a walking beam applies a force to the landing gear trunnion to retract and extend the main landing gear.

Location

The main landing gear actuator is outboard of the main landing gear shock strut. The head end attaches to a beam hanger and walking beam pivot on the wing structure outboard of the shock strut. The rod end attaches to a fitting on the main landing gear shock strut at the trunnion.

Physical Description

The main landing gear actuator is a double-acting, unbalanced-type actuator. It contains an internal, variable orifice slide/sleeve snubber in the head-end to control the rate of the gear.

The hydraulic connections to the actuator are different sizes. This prevents incorrect connection of the hydraulic hoses when you remove and replace the actuator.

The actuator weighs 42 pounds (19 kg).

Functional Description

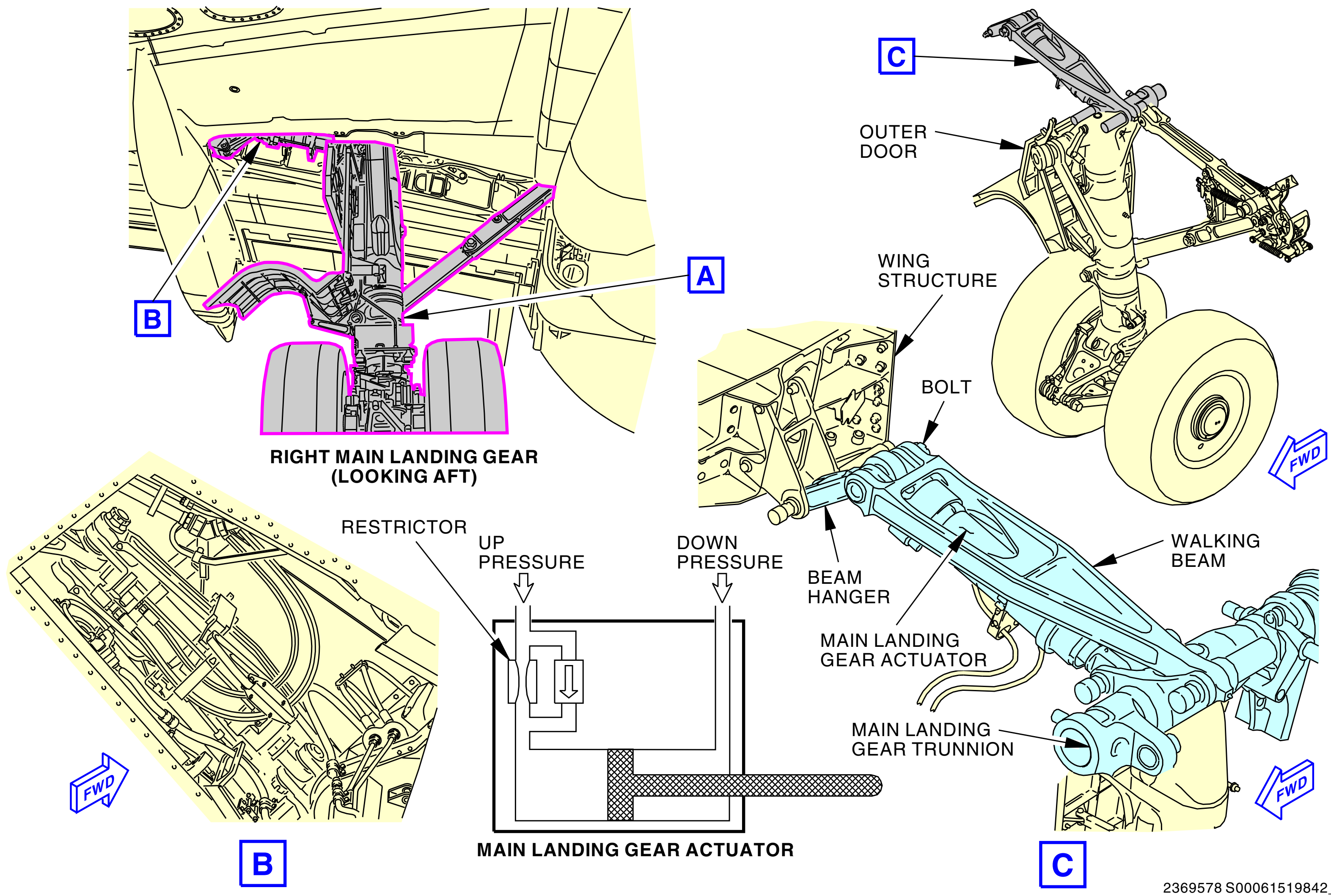
The actuator and walking beam work together to raise and lower the main landing gear. The walking beam decreases the force that goes to the structure during actuator operations.

When the main gear retracts, the inboard force from the actuator rod end is applied directly to the gear. The outboard reaction force from the cylinder of the actuator is transmitted to the shock strut through the walking beam. Action and reaction forces combine together and provide the power to raise the gear. The reaction force that results rotates the gear aroaund its trunnion axis. Forces caused by the rotation are transmitted to the structure through the beam hanger.

During extension, the forces operate in the opposite direction to extend the gear.

The restrictor on the up pressure port of the actuator decreases the flow of fluid from the actuator to 8 gpm (30 lpm) during gear extension. This prevents an uncontrolled main landing gear extension when a hydraulic hose or tube fails. The check valve permits full flow into the actuator during landing gear retraction.

MLG EXTENSION AND RETRACTION - MAIN LANDING GEAR ACTUATOR



MLG EXTENSION AND RETRACTION - MAIN LANDING GEAR ACTUATOR

MLG EXTENSION AND RETRACTION - UPLOCK MECHANISM AND ACTUATOR

Purpose

The MLG uplock mechanism holds the main landing gear in the up and locked position.

The MLG uplock actuator unlocks the MLG uplock mechanism during main landing gear extension.

Location

There are two MLG uplock mechanisms, one for each MLG, on the ceiling on the outboard edges of the main landing gear wheel well.

The MLG uplock actuators attach horizontally above the MLG uplock mechanisms.

Physical Description

The MLG uplock actuator is a two-position, piston-type, single-acting, unbalanced-type actuator.

The main landing gear uplock mechanism has these main components:

- Uplock hook
- Springs (2)
- Uplock actuator.

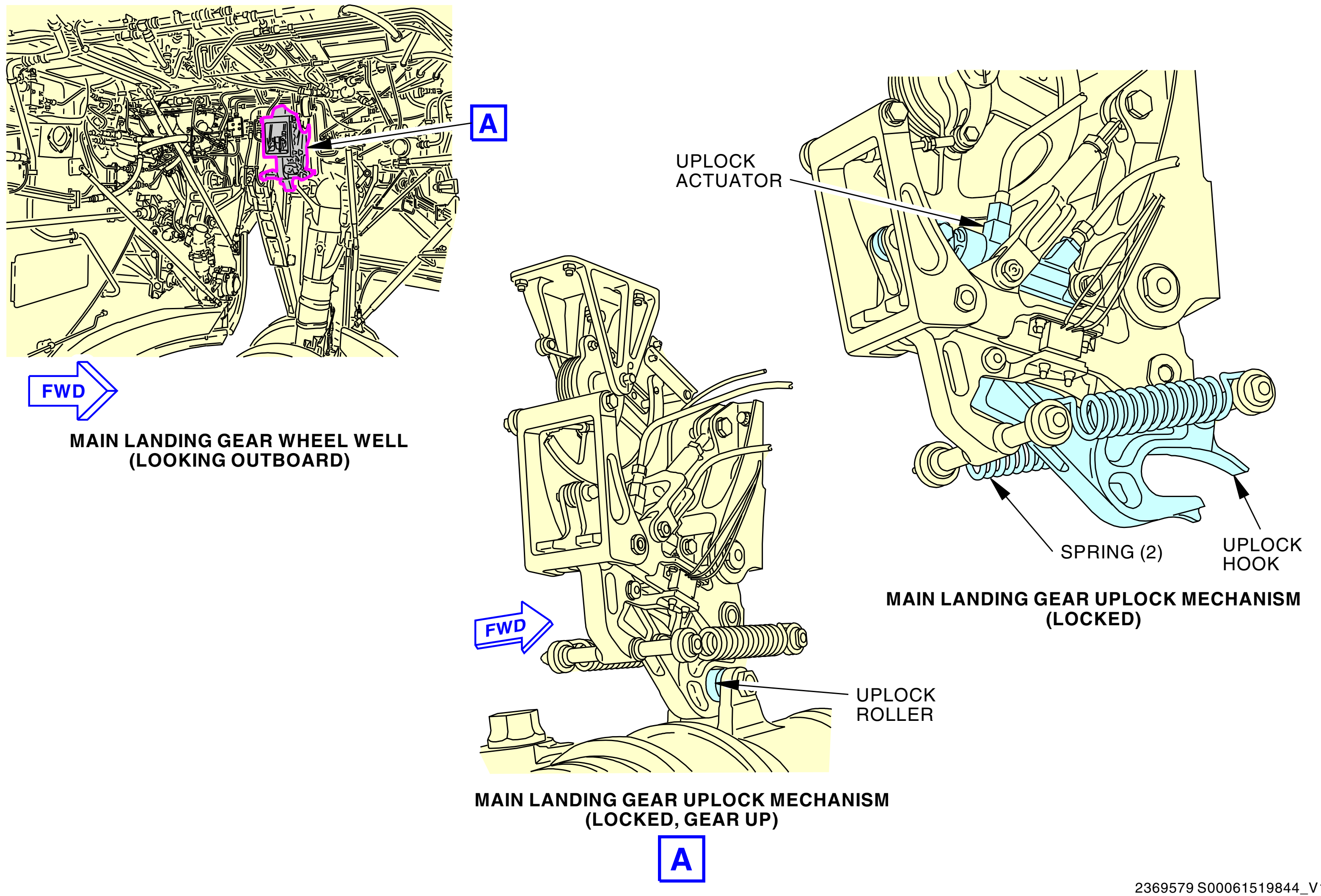
Functional Description

Hydraulic pressure extends the MLG uplock actuator. This controls movement of the MLG uplock mechanism to the unlocked position.

The MLG uplock actuator does not receive up pressure during landing gear retraction.

The MLG uplock mechanism uses over-center locking to keep the main landing gear up and locked. Two springs hold the uplock hook in the up and locked position.

MLG EXTENSION AND RETRACTION - UPLOCK MECHANISM AND ACTUATOR



MLG EXTENSION AND RETRACTION - UPLOCK MECHANISM AND ACTUATOR

MLG EXTENSION AND RETRACTION - UPLOCK MECHANISM AND ACTUATOR - FUNCTIONAL DESCRIPTION

General Description

The MLG uplock mechanism uses over-center locks to keep the main landing gear up and locked.

The MLG uplock actuator retracts to unlock the main landing gear.

Main Landing Gear Extension

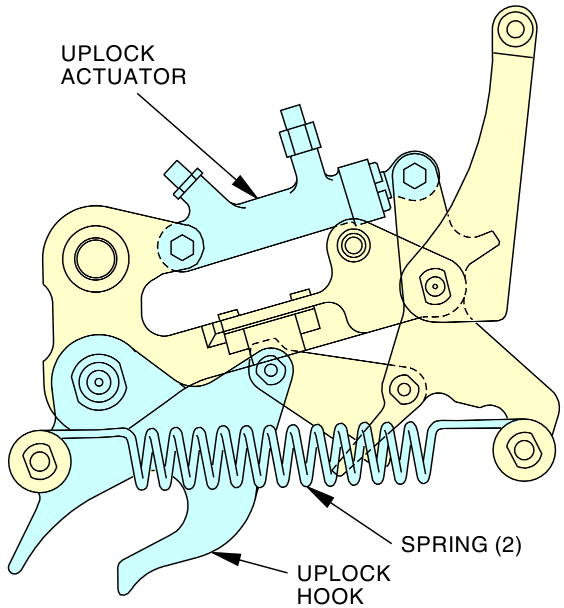
During main landing gear extension, the MLG uplock actuator receives down pressure to retract. The actuator moves the uplock mechanism to the unlocked position.

Main Landing Gear Retraction

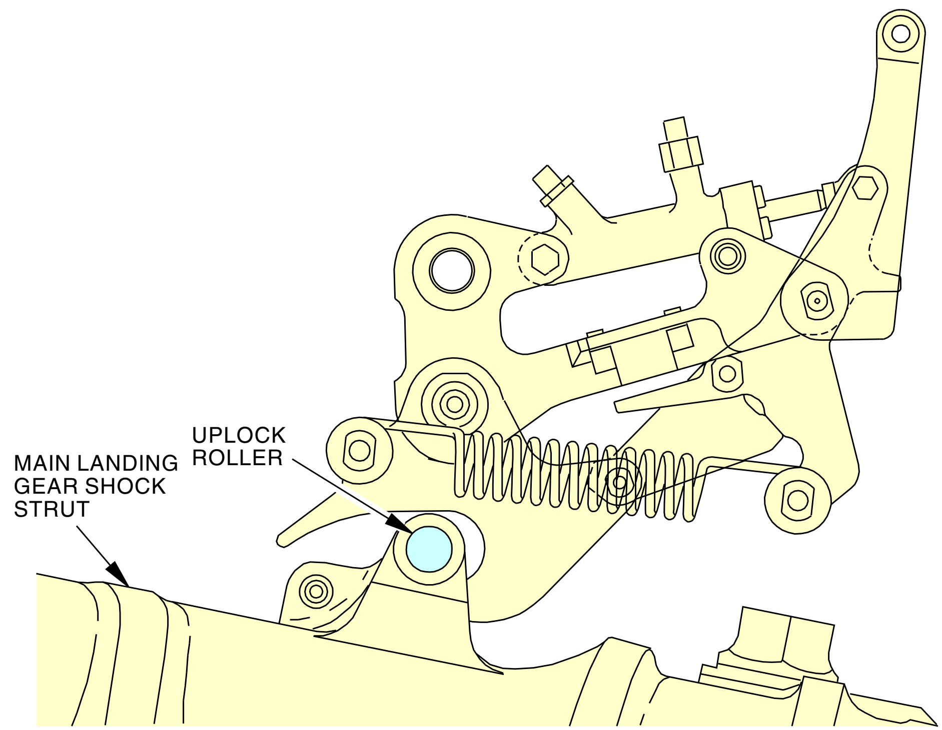
During main landing gear retraction, the roller on the MLG shock strut engages the uplock hook, this moves the uplock mechanism to the over-center and locked position. Lock springs hold the mechanism in the up and locked position.

The restrictor in the down port of the actuator slows the movement of the uplock mechanism when the roller moves into the uplock hook. The restrictor reduces flow to .41 gpm at 3000 psi.

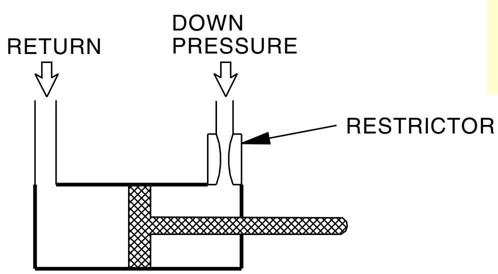
MLG EXTENSION AND RETRACTION - UPLOCK MECHANISM AND ACTUATOR - FUNCTIONAL DESCRIPTION



MAIN LANDING GEAR UPLOCK MECHANISM
(UNLOCKED, GEAR DOWN)



MAIN LANDING GEAR UPLOCK MECHANISM
(LOCKED, GEAR UP)



UPLOCK ACTUATOR

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MLG EXTENSION AND RETRACTION - UPLOCK MECHANISM AND ACTUATOR - FUNCTIONAL DESCRIPTION

MLG EXTENSION AND RETRACTION - DOWNLOCK MECHANISM AND ACTUATOR

General

The MLG downlock mechanism holds the main landing gear in the down and locked position.

The downlock springs hold the downlock mechanism in an over-center locked position when the main landing gear moves to the down and locked position.

The downlock actuator locks and unlocks the downlock mechanism during main landing gear extension and retraction.

Location

The main landing gear downlock mechanism and downlock actuator are between the reaction link and upper side strut.

Physical Description

The downlock springs attach to the inboard side of the reaction link and to the downlock mechanism.

The downlock actuator is a piston-type, double-acting, unbalanced actuator. The body of the downlock actuator attaches to the inboard side of the reaction link. The rod end of the downlock actuator attaches to the downlock mechanism.

The downlock actuator has a restrictor relief valve at the body end of the actuator that decreases the flow to 0.26 gpm at 2550 psi. The relief valve opens at 2800 - 3100 psi.

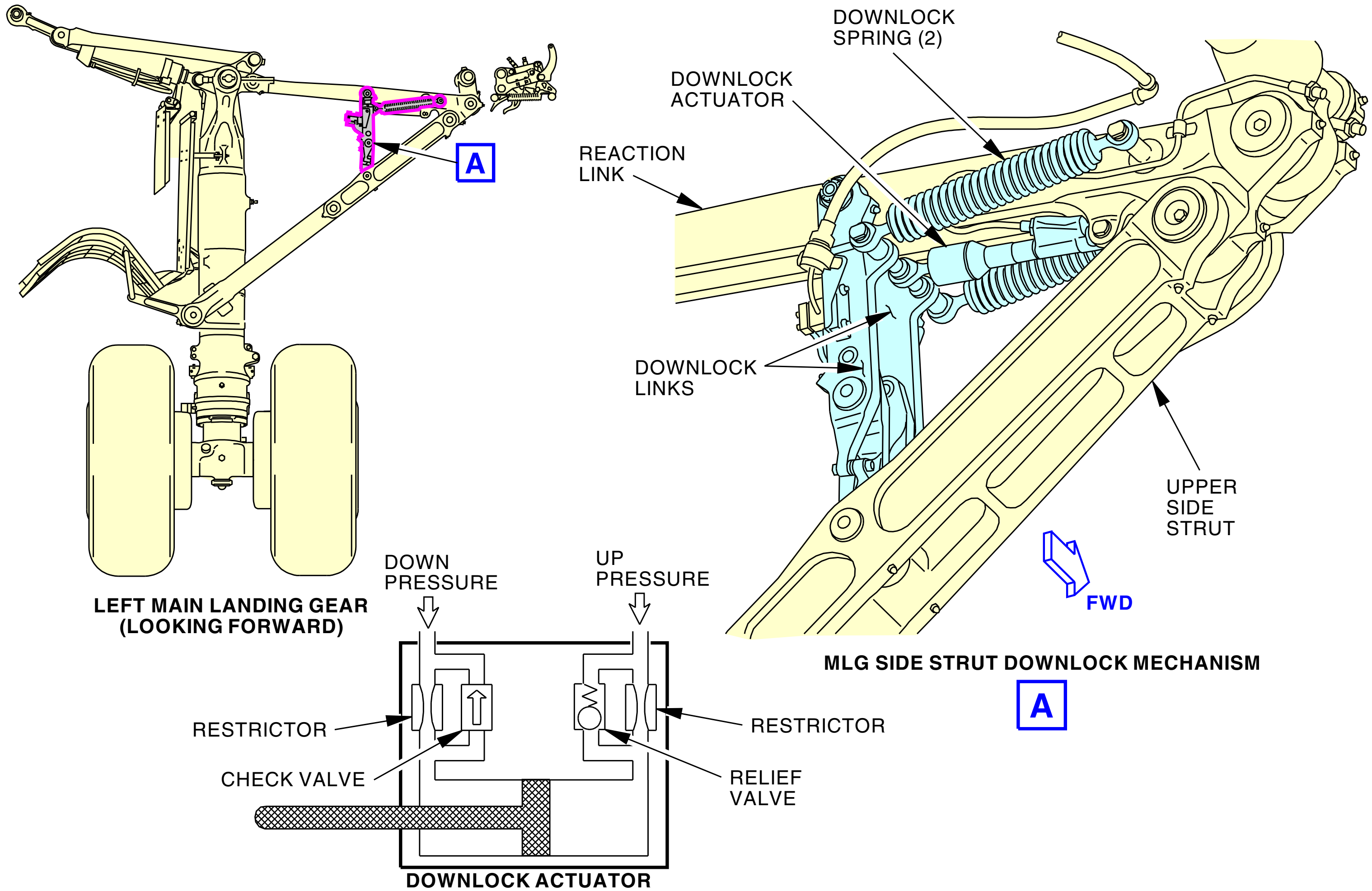
The downlock actuator has a restrictor check valve at the rod end of the actuator that decreases the flow to 0.29 gpm at 3000 psi.

Functional Description

During main landing gear extension, the downlock actuator receives down pressure to retract. The actuator retracts to lock the downlock mechanism during main landing gear extension.

During main landing gear retraction, the downlock actuator receives up pressure to extend. The actuator extends to unlock the downlock mechanism during main landing gear retraction.

MLG EXTENSION AND RETRACTION - DOWNLOCK MECHANISM AND ACTUATOR



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MLG EXTENSION AND RETRACTION - DOWNLOCK MECHANISM AND ACTUATOR

MLG EXTENSION AND RETRACTION - TRANSFER CYLINDER

Purpose

During the extension and retraction sequences, the transfer cylinder gives a time delay. This lets the main landing gear downlock or uplock actuators unlock before the main gear actuator receives pressure.

Location

The transfer cylinder is on the rear spar of the left and right wings.

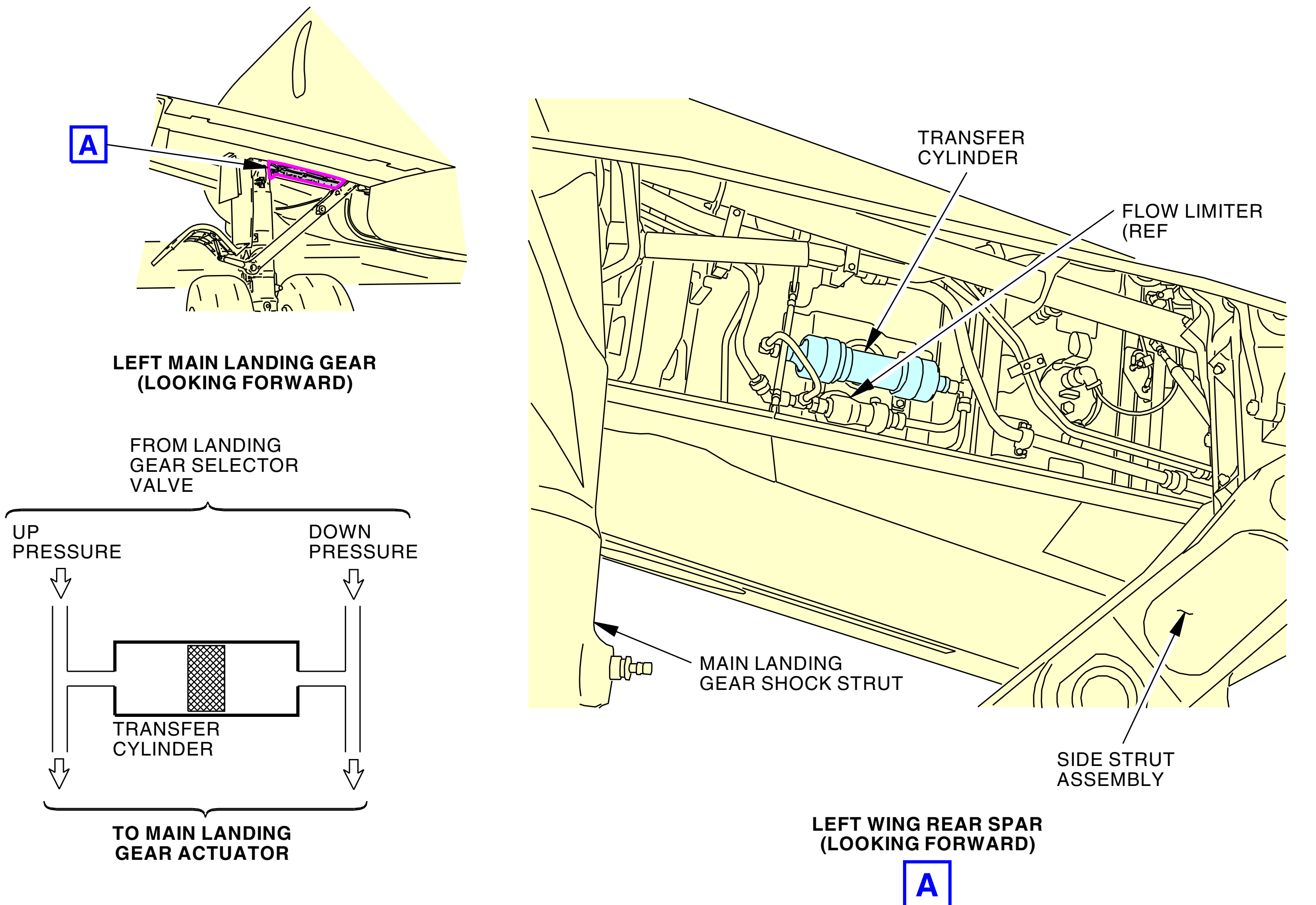
Physical Description

The transfer cylinder has a piston that moves freely in the cylinder. One side of the piston connects to the down pressure. The other side connects to the up pressure.

Functional Description

The piston moves when up or down pressure goes to the transfer cylinder. When the piston moves, it pushes fluid on the side that does not have pressure. This gives a time delay to the extend or retract side of the main gear actuator and the downlock actuator.

MLG EXTENSION AND RETRACTION - TRANSFER CYLINDER



MLG EXTENSION AND RETRACTION - TRANSFER CYLINDER

MLG EXTENSION AND RETRACTION - FRANGIBLE FITTING

Purpose

The frangible fitting removes up pressure from the main landing gear actuator when a damaged, spinning tire moves into the main landing gear wheel well. This prevents damage to components in the wheel well.

Location

There is a frangible fitting on the outboard side of both wheel well rings in the main landing gear wheel well.

Physical Description

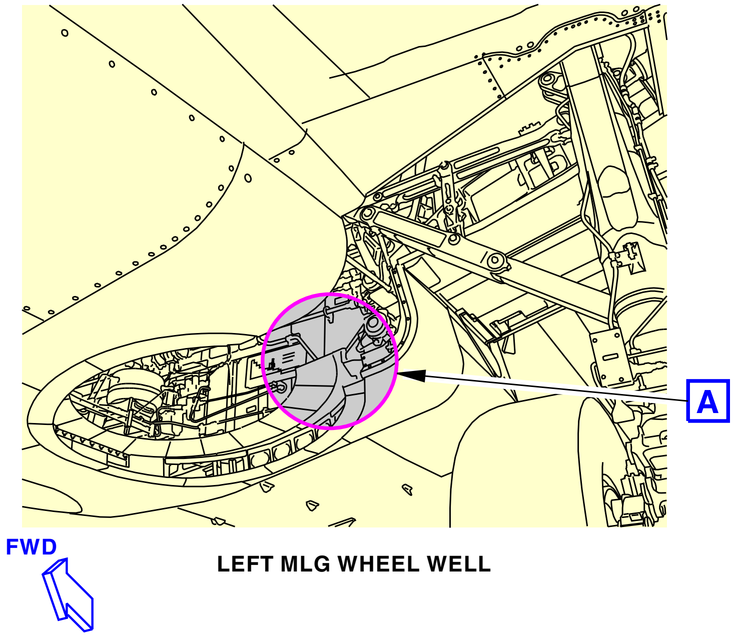
The frangible fitting is a normally closed valve. It opens when a force removes the lever from the fitting.

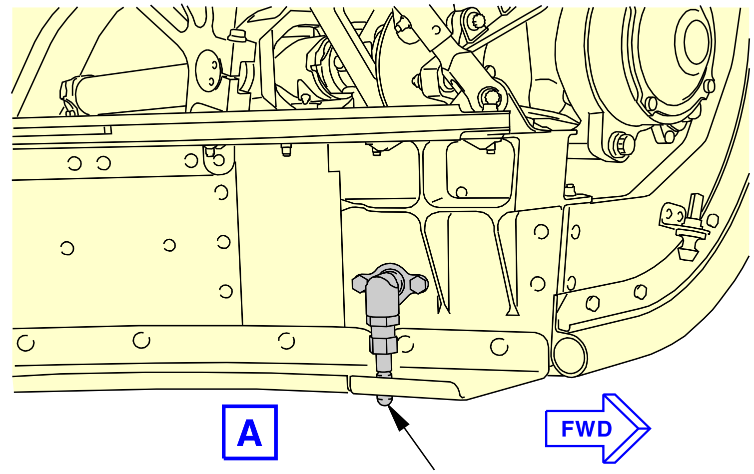
Functional Description

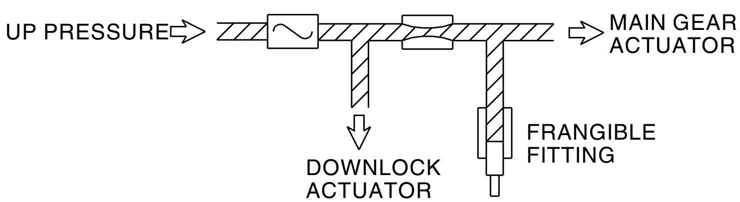
The frangible fitting operates during this sequence of events:

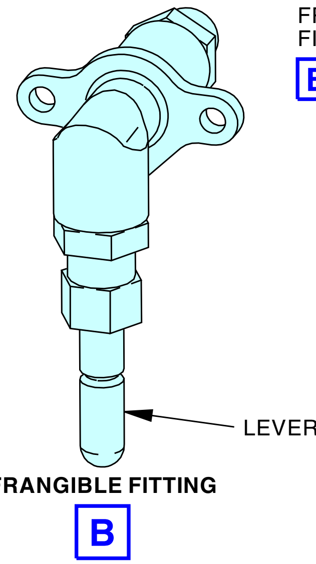
- A section of tread partially separates from a main landing gear tire
- Landing gear starts to retract
- Gear retract braking has a fault and does not stop the wheel before it moves into the wheel well
- The section of tread removes the lever from the frangible fitting
- Frangible fitting opens
- Up pressure is removed from the main landing gear actuator
- Main landing gear that has the damaged tire stops retraction and moves towards the extended position
- Flow limiter in the up pressure line limits the flow to 8 gpm (30 lpm) from the volume fuse to the frangible fitting and MLG actuator
- Volume fuse in the up pressure line closes when the hydraulic flow through the frangible fitting increases to 180-250 cubic inches (3-4 liters). This stops the loss of fluid from the hydraulic system.

MLG EXTENSION AND RETRACTION - FRANGIBLE FITTING









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MLG EXTENSION AND RETRACTION - FRANGIBLE FITTING

MLG EXTENSION AND RETRACTION - FUNCTIONAL DESCRIPTION

General

The extension and retraction sequence is the same for the left and the right main landing gear.

The MLG extension and retraction system includes these hydraulic components:

- Main landing gear actuator
- Downlock actuator
- Uplock actuator
- Transfer cylinder
- Frangible fitting(s).

Extension

The landing gear selector valve supplies down pressure when the landing gear lever moves to the down position.

Down pressure goes to the transfer cylinder. This sets the piston in the transfer cylinder to move to the up side. This gives a time delay to let the uplock actuator unlock the uplock mechanism. The restrictor/check valve controls the transfer cylinder rate.

Down pressure also goes to the uplock actuator. The uplock actuator retracts and this unlocks the uplock mechanism.

The shimmy damper decreases main landing gear shimmy. The shimmy damper connects to the return line between the landing gear selector valve and the landing gear transfer valve.

See the MLG and doors section for more information about the shimmy damper. (SECTION 32-10)

When the transfer cylinder piston comes to the end of the up side, down pressure goes to the down side of the gear actuator. The gear actuator applies an extension force on the main landing gear and moves it down.

Down pressure goes to retract the downlock actuator. The downlock actuator moves the downlock strut to the locked position as the main landing gear extends.

Retraction

The landing gear selector valve supplies up pressure when the landing gear lever moves to the up position.

A flow limiter in the up pressure line limits the flow to the main landing gear actuator to 8 gpm (30 lpm). The flow limiter makes sure hydraulic system pressure stays normal for other airplane systems that also use hydraulic pressure. The flow limiter also controls the transfer cylinder rate and the main landing gear extension and retraction rate.

Up pressure goes to the transfer cylinder. This sets the piston in the transfer cylinder to move to the down side. This gives a time delay to let the downlock actuator extend to unlock the downlock strut.

Up pressure goes to the downlock actuator. The downlock actuator extends and unlocks the downlock strut.

When the transfer cylinder piston comes to the end of the down side, up pressure goes to the up side of the gear actuator. The gear actuator applies a retraction force on the main landing gear and moves it up.

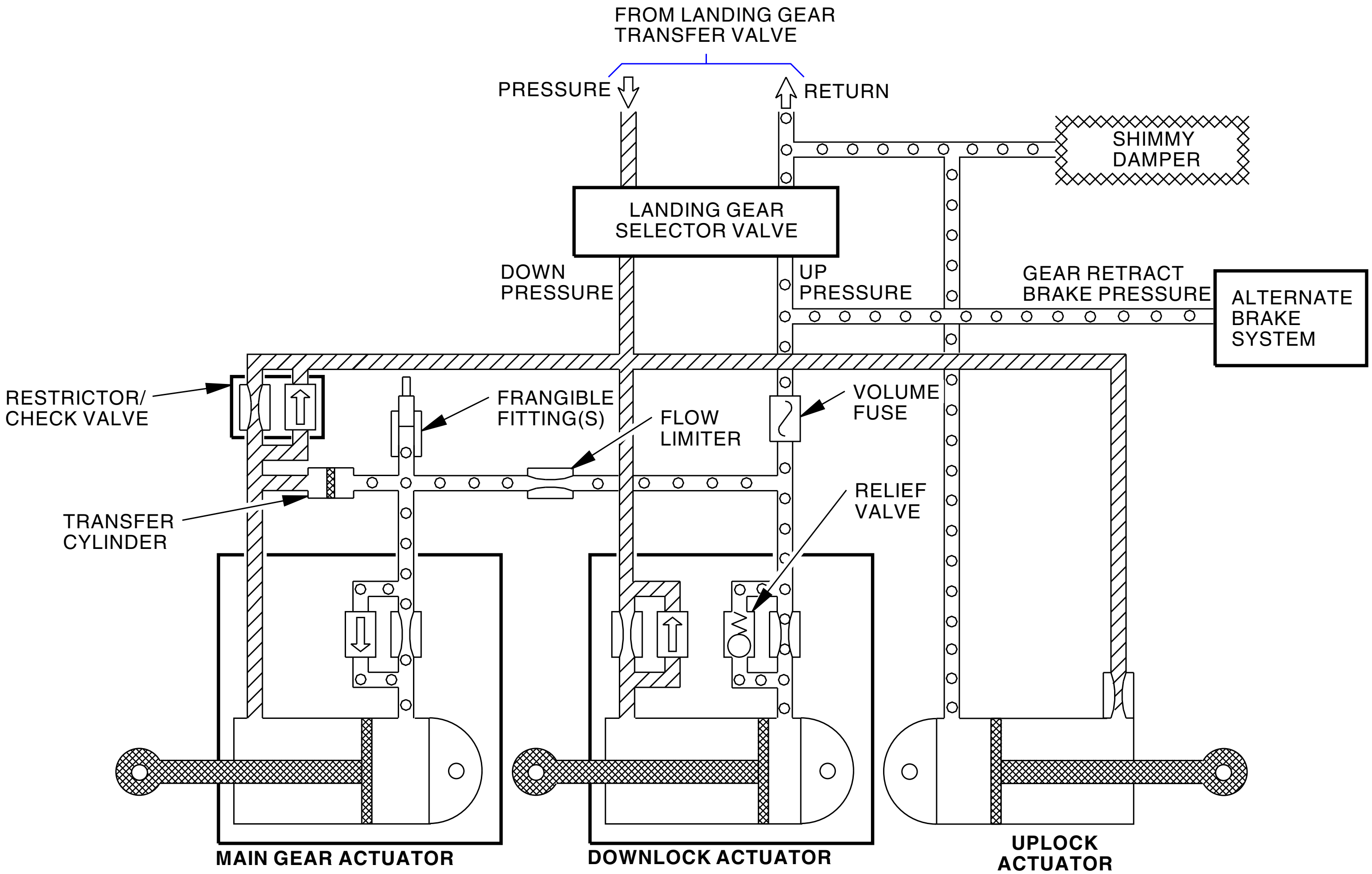
As the gear uplock roller moves into the hook of the uplock mechanism, the uplock mechanism moves to the locked position. The uplock actuator does not get up pressure.

The frangible fitting(s) removes up pressure from the main landing gear actuator if a damaged, spinning tire moves into the main landing gear wheel well. This prevents damage to components in the wheel well. A volume fuse in the up pressure line closes when the hydraulic flow from the frangible fitting(s) increases to 180-250 cubic inches (3-4 liters). This prevents hydraulic fluid loss if there is a leak in the system.

Up pressure also goes to the alternate and gear retract brake system. This stops wheel rotation during main landing gear retraction.

See the Wheels and Brakes section for more information about the gear retract brake system. (SECTION 32-41)

MLG EXTENSION AND RETRACTION - FUNCTIONAL DESCRIPTION



MLG EXTENSION AND RETRACTION - FUNCTIONAL DESCRIPTION

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NLG EXTENSION AND RETRACTION - GENERAL DESCRIPTION

General

Hydraulic system A usually supplies pressure to extend and retract the nose landing gear. Hydraulic system B supplies alternate pressure for retraction only. The landing gear transfer valve controls the pressure source of hydraulic system A or hydraulic system B to supply the nose landing gear.

The landing gear selector valve supplies down or up pressure to extend or retract the nose landing gear. The landing gear control lever operates the landing gear selector valve.

WARNING	MAKE SURE ALL PERSONS AND EQUIPMENT ARE CLEAR OF THE NOSE LANDING GEAR. FAST MOVEMENT OF THE NOSE LANDING GEAR CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

CAUTION	DO NOT TURN THE STEERING WHEEL WHEN THE SHOCK STRUT OF THE NOSE LANDING GEAR IS FULLY EXTENDED. YOU CAN CAUSE DAMAGE TO THE CENTERING CAMS IN THE SHOCK STRUT IF YOU DO THIS.

Pressure also goes to the nose wheel steering system. This allows for nose wheel steering rotation.

See the Nose Wheel Steering section for more information about nose wheel steering. (SECTION 32-51)

Components

These are the components of the nose landing gear extension and retraction system:

- Nose landing gear actuator
- Lock actuator
- Lock mechanism
- Bungee spring
- Valve manifold
- Transfer cylinder
- Fuse (2).

NLG Actuator

The nose landing gear actuator supplies the force to retract and extend the nose landing gear.

Lock Mechanism and Lock Actuator

The NLG lock mechanism locks the NLG in the extended or the retracted position. Two bungee springs keep the lock links in this positions.

The lock actuator unlocks and locks the gear during extension and retraction.

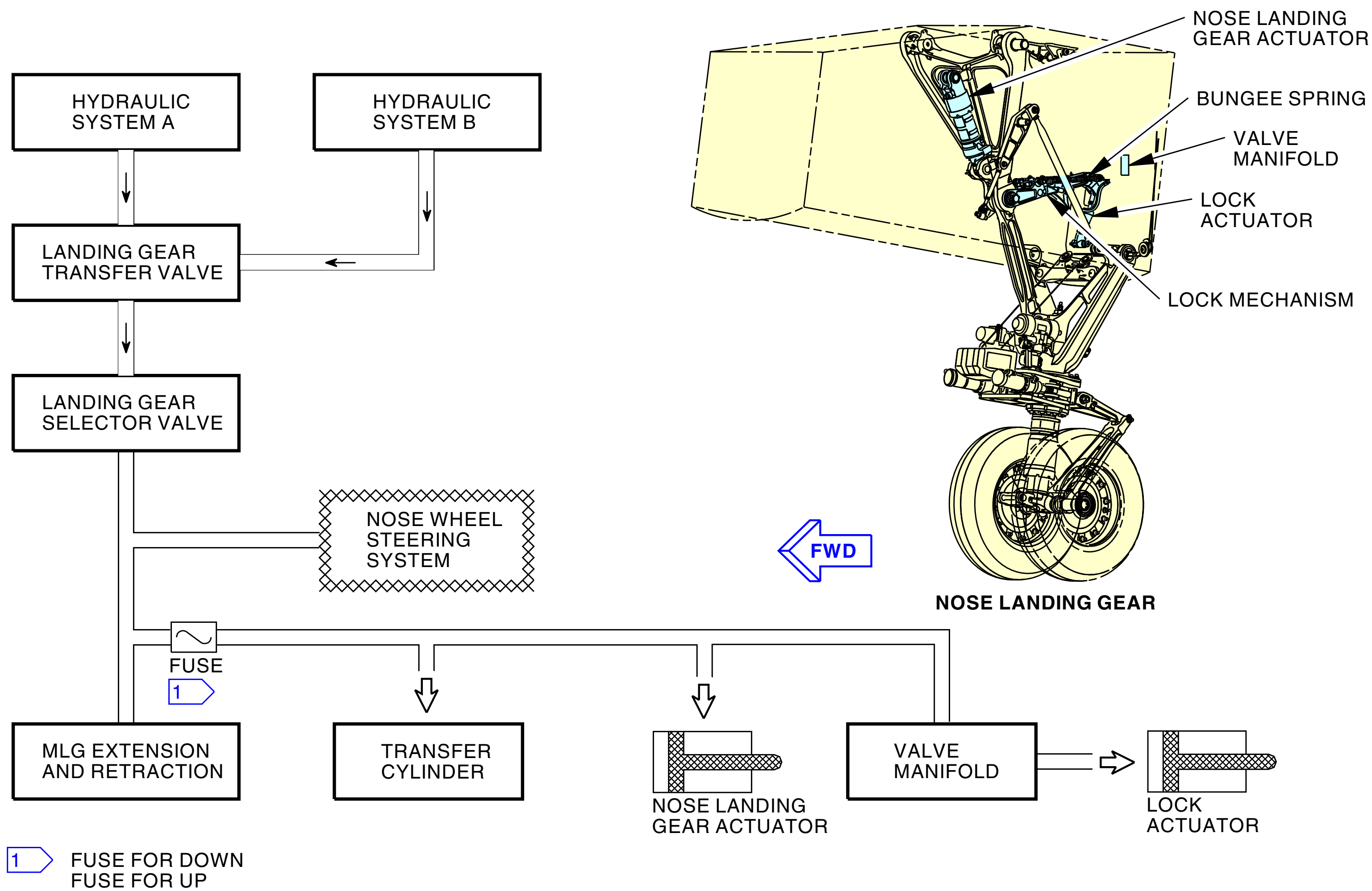
Valve Manifold

The valve manifold controls extension and retraction hydraulic fluid to the lock actuator.

Transfer Cylinder

The transfer cylinder gives a time delay to let the nose landing gear unlock before the nose gear actuator moves the gear.

NLG EXTENSION AND RETRACTION - GENERAL DESCRIPTION



NLG EXTENSION AND RETRACTION - GENERAL DESCRIPTION

NLG EXTENSION AND RETRACTION - OPERATION

Retraction

This is the retraction sequence for the nose landing gear:

- Landing gear control lever moved to UP
- Lock actuator retracts
- Lock mechanism unlocks
- Nose landing gear actuator extends
- Nose landing gear retracts
- Lock actuator continues to retract
- Lock mechanism locks
- PSEU System 1 and 2 provide an auto-off function by de-energizing the UP command ten seconds after all gears are up and locked..

When the landing gear control lever is in the UP position, hydraulic pressure pressurizes the NLG up lines through the selector valve to the NLG transfer cylinder and NLG lock actuator. The transfer cylinder stroke delays full pressurization to the NLG actuator until the lock actuator unlocks the NLG lock links. After the lock links are unlocked, pressure increases in the head-end of the NLG actuator and it extends. This retracts the NLG landing gear.

As the NLG landing gear gets the up position, the restrictor decreases the flow of fluid that goes to the head-end of the NLG actuator. The NLG lock actuator and lock springs move the NLG lock links overcenter to the locked position. This locks the NLG in the retracted position.

PSEU System 1 and 2 provide an auto-off function by de-energizing the UP command ten seconds after all gears are up and locked.

Extension

This is the extension sequence for the nose landing gear:

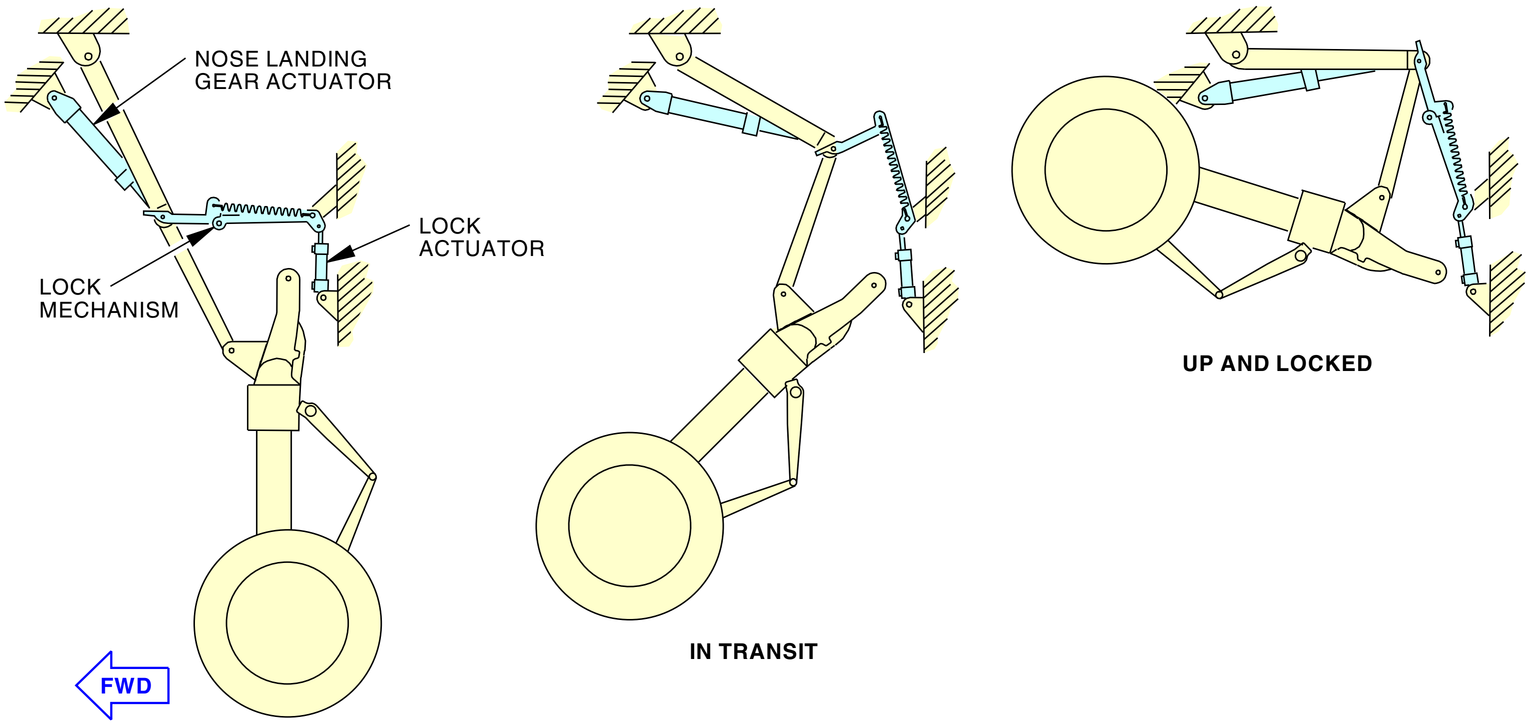
- Landing gear control lever moved to DOWN
- Lock actuator extends
- Lock mechanism unlocks
- Nose landing gear actuator retracts
- Nose landing gear extends
- Lock actuator continues to extend
- Lock mechanism locks.

When the landing gear control lever is in the DOWN position, hydraulic pressure pressurizes the NLG down lines through the selector valve to the NLG transfer cylinder and NLG lock actuator. The transfer cylinder stroke delays full pressurization to the NLG actuator until the lock actuator unlocks the lock links. After the lock links unlock, pressure increases in the rod-end of the NLG actuator and it retracts. The landing gear extends by actuator force, landing gear weight, and airloads.

As the NLG landing gear gets to the down position, the restrictor decreases the flow of fluid out of the head-end of the NLG actuator. The lock actuator and lock springs move the lock links to the locked position. This locks the NLG in the extended position.

When the landing gear lever is in the down position, the lock actuator, NLG actuator, and transfer cylinder remain pressurized.

NLG EXTENSION AND RETRACTION - OPERATION



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NLG EXTENSION AND RETRACTION - OPERATION

NLG EXTENSION AND RETRACTION - NOSE LANDING GEAR ACTUATOR

Purpose

The nose landing gear actuator supplies the force to retract and extend the nose landing gear.

Location

The nose landing gear actuator is in the nose landing gear wheel well, forward of the upper drag brace. The head end attaches to a fitting on the upper bulkhead of the wheel well. The rod end attaches to a fitting on the upper drag brace.

Physical Description

The nose landing gear actuator is a two-position piston-type actuator.

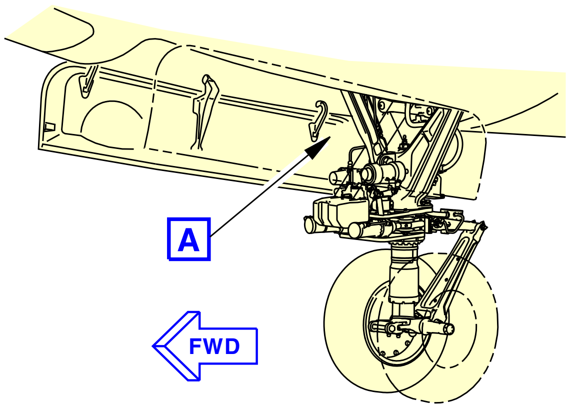
The actuator weighs 31 pounds (14 kg).

Functional Description

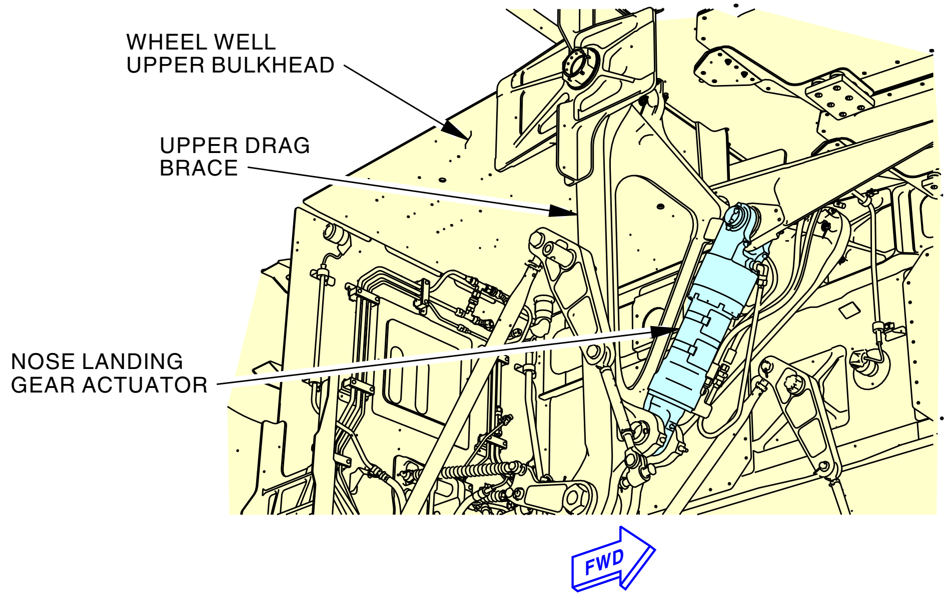
The actuator retracts to extend the nose landing gear. The actuator extends to retract the nose landing gear.

The flow restrictor on the up pressure port of the actuator decreases the flow of fluid from the actuator to 3 gpm (11 lpm) during gear extension. This prevents an uncontrolled nose landing gear extension if a hydraulic hose or tube fails.

NLG EXTENSION AND RETRACTION - NOSE LANDING GEAR ACTUATOR



NOSE LANDING GEAR
(LOOKING AFT)



NOSE LANDING GEAR WHEEL WELL
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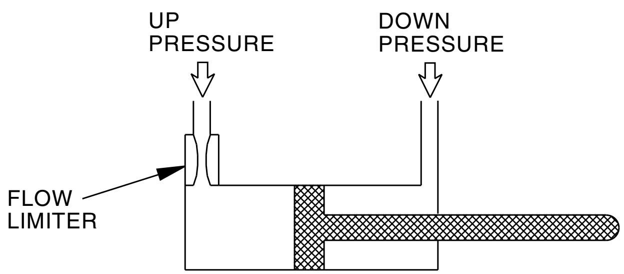

NOSE LANDING GEAR ACTUATOR

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NLG EXTENSION AND RETRACTION - NOSE LANDING GEAR ACTUATOR

NLG EXTENSION AND RETRACTION - LOCK MECHANISM AND LOCK ACTUATOR

Purpose

The NLG lock mechanism uses an over-center device to lock the NLG in the extended or the retracted position. Two bungee springs keep the lock links in these positions.

The nose landing gear (NLG) lock actuator unlocks the NLG lock mechanism at the start of an extension or retraction sequence. The lock actuator also locks the lock mechanism when the NLG moves to the fully extended or retracted positions.

Location

The NLG lock mechanism connects to the upper and lower NLG drag brace joint and to the aft bulkhead of the NLG wheel well.

The NLG lock actuator is on the aft bulkhead of the nose landing gear wheel well, near the valve manifold.

Physical Description

The NLG lock mechanism has these components:

- Forward lock link
- Aft lock link
- Bungee springs (2).

The NLG lock actuator is a two-position hydraulic actuator.

Retraction

Before gear retraction, the NLG lock actuator retracts. This unlocks the NLG lock mechanism and lets the NLG retract.

The hydraulic pressure stays on the retract side of the NLG lock actuator while the gear moves up.

The NLG lock actuator moves the NLG lock mechanism to the lock position when the NLG moves to the retracted position.

The bungee springs hold the lock links in the over-center locked position. This holds the NLG in the retracted position.

Extension

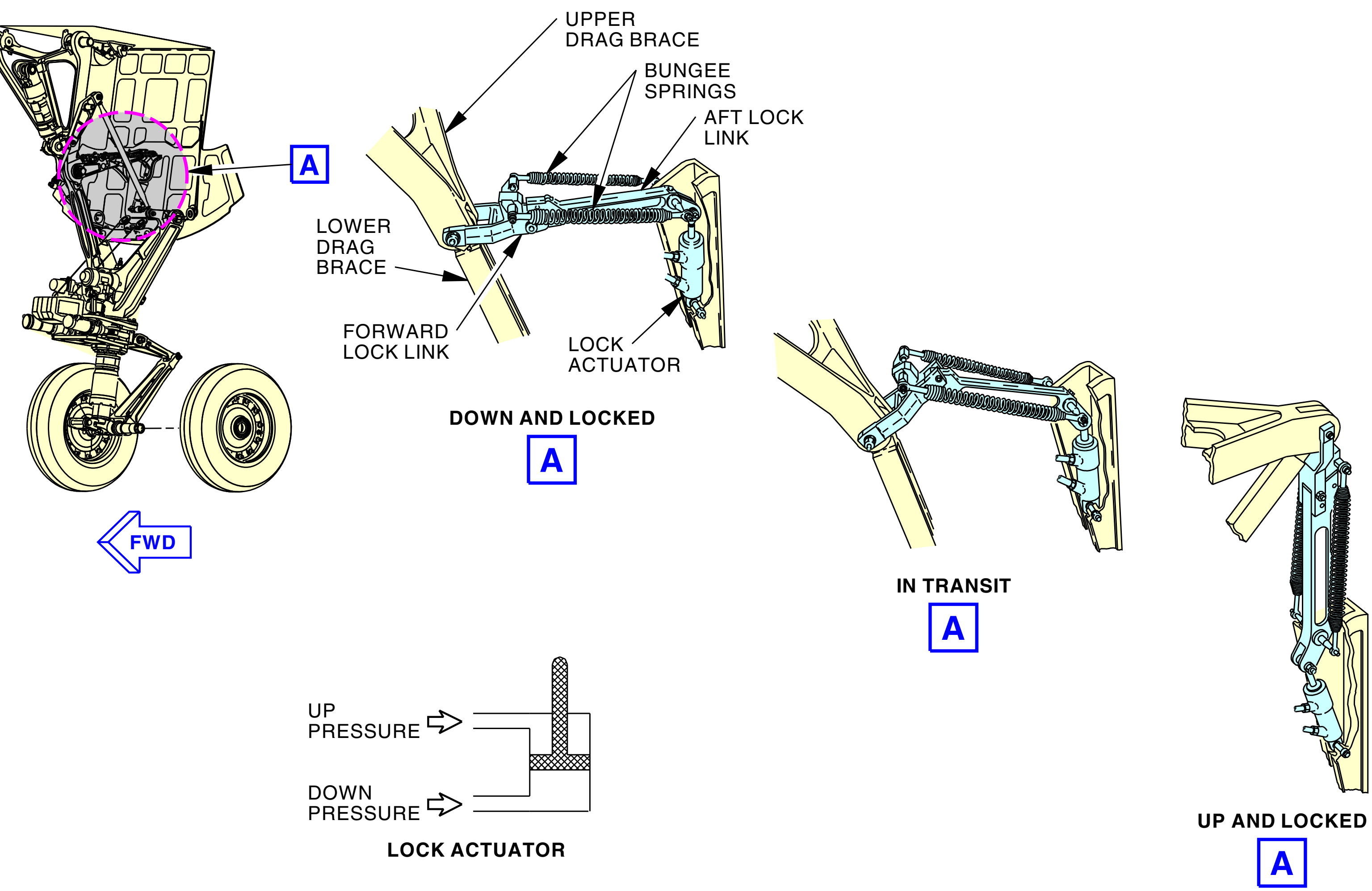
Before gear extension, the NLG lock actuator extends. This unlocks the NLG lock mechanism and lets the NLG extend.

Hydraulic pressure stays on the extend side of the NLG lock actuator while the gear moves down.

The NLG lock actuator moves the NLG lock mechanism to the lock position when the NLG moves to the extended position.

The bungee springs hold the lock links in the over-center locked position. This holds the NLG in the extended position.

NLG EXTENSION AND RETRACTION - LOCK MECHANISM AND LOCK ACTUATOR



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NLG EXTENSION AND RETRACTION - LOCK MECHANISM AND LOCK ACTUATOR

NLG EXTENSION AND RETRACTION - VALVE MANIFOLD

Purpose

The valve manifold controls extension and retraction hydraulic fluid to the lock actuator.

Location

The valve manifold is on the aft bulkhead of the nose landing gear wheel well, near the lock actuator.

Physical Description

The valve manifold has two restrictors and two pressure relief valves.

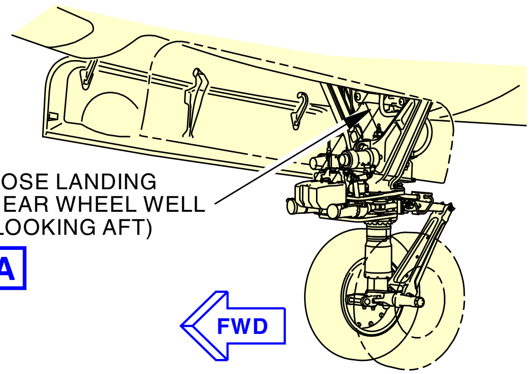
Functional Description

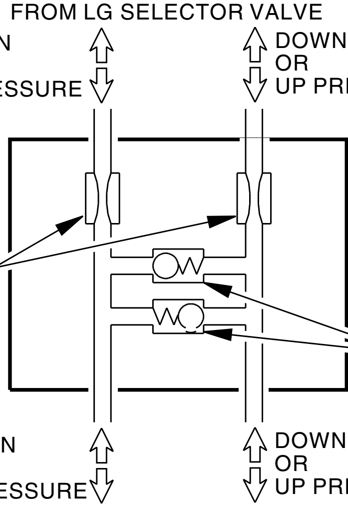
The valve manifold controls hydraulic fluid flow to and from the lock actuator. The valve manifold also limits hydraulic pressure in the lock actuator.

The restrictors decrease the force the lock actuator applies on the lock links. The restrictors limit the hydraulic flow to 0.4 gpm (1.5 lpm).

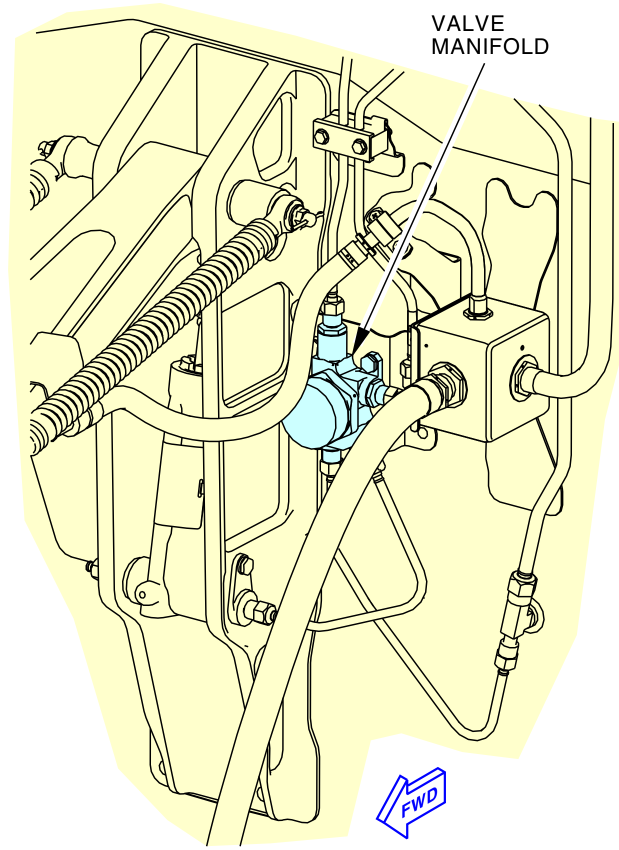
The pressure relief valves release excess pressure that results from the movement of the nose landing gear backdrives the lock actuator. The valves open at 3150 psi.

NLG EXTENSION AND RETRACTION - VALVE MANIFOLD





VALVE MANIFOLD



NOSE LANDING GEAR WHEEL WELL (LOOKING AFT)

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NLG EXTENSION AND RETRACTION - VALVE MANIFOLD

NLG EXTENSION AND RETRACTION - TRANSFER CYLINDER

Purpose

During the extension and retraction sequence, the transfer cylinder gives a time delay to let the nose landing gear unlock before the nose landing gear actuator receives pressure.

Location

The transfer cylinder is on the forward bulkhead of the nose landing gear wheel well.

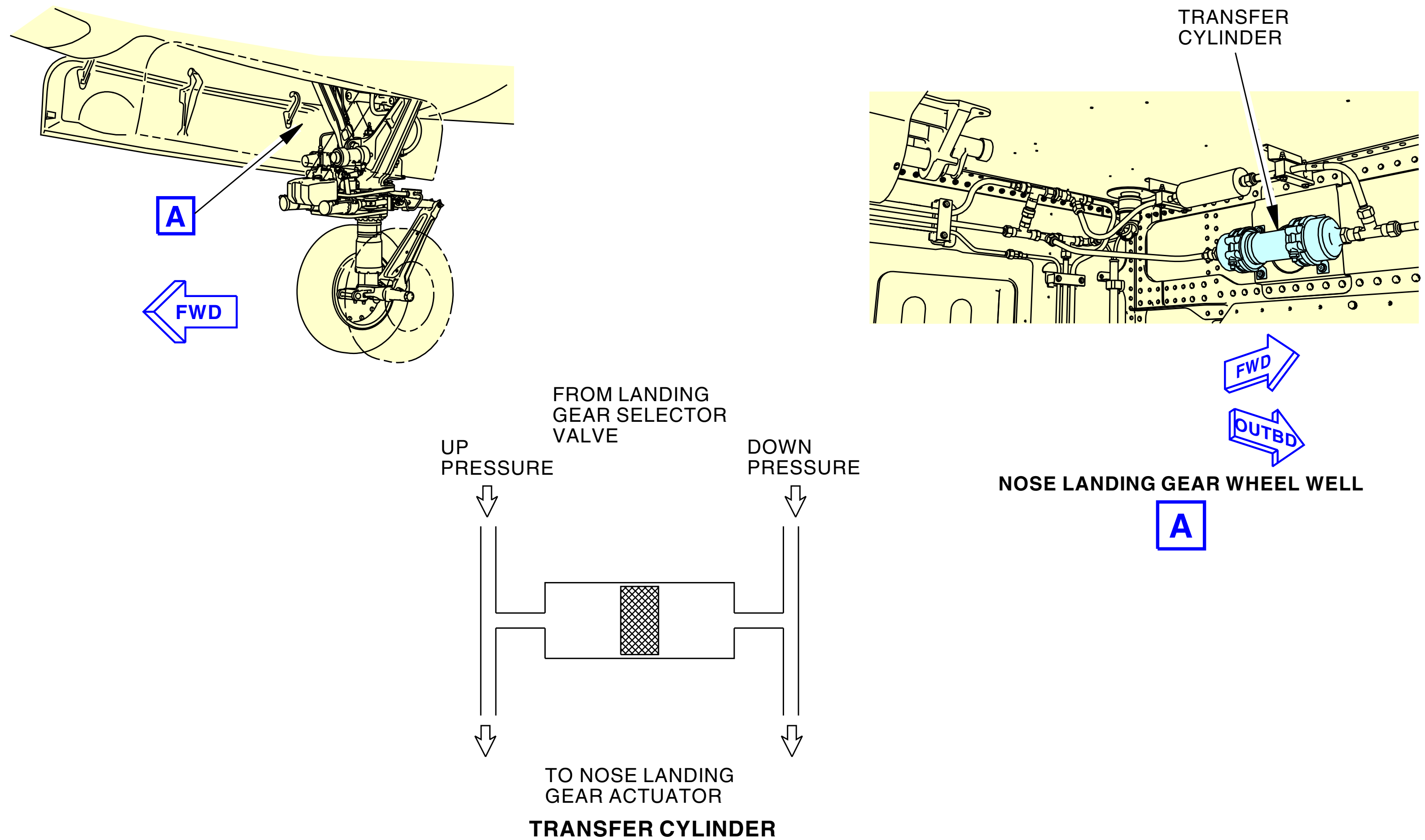
Physical Description

The transfer cylinder has a piston that moves freely in the cylinder. One side of the piston connects to the down pressure. The other side connects to the up pressure.

Functional Description

The piston moves when up or down pressure goes to the transfer cylinder. When the piston moves, it pushes fluid out of the transfer cylinder on the side that does not have pressure. This gives a time delay to the extend or retract side of the nose landing gear actuator and the lock actuator.

NLG EXTENSION AND RETRACTION - TRANSFER CYLINDER



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NLG EXTENSION AND RETRACTION - TRANSFER CYLINDER

NLG EXTENSION AND RETRACTION - FUNCTIONAL DESCRIPTION

General

The NLG extension and retraction system includes these hydraulic components:

- Gear actuator
- Lock actuator
- Transfer cylinder
- Valve manifold.

Extension

The landing gear selector valve supplies down pressure when the landing gear lever is in the down position. A rate fuse (in the MLG wheel well forward bulkhead) in the down pressure line closes when the hydraulic flow increases to 10 gpm (38 lpm). This prevents hydraulic fluid loss if there is a leak in the system. This rate fuse in the down pressure line permits a variable amount of fluid for nose wheel steering.

Down pressure goes to the transfer cylinder. This sets the piston in the transfer cylinder to move to the up side. This gives a time delay to let the lock actuator unlock the lock mechanism.

Down pressure also goes to the lock actuator. The lock actuator extends to unlock the lock mechanism.

When the transfer cylinder piston gets to the end of the up side, down pressure goes to the down side of the gear actuator. The gear actuator applies an extension force on the nose landing gear and moves it down.

As the nose landing gear moves to the down and locked position, the lock actuator again extends with down pressure to lock the lock mechanism.

Retraction

The landing gear selector valve supplies up pressure when the landing gear lever is in the up position. A volume fuse (in the NLG wheel well) in the up pressure line closes when the hydraulic flow increases to 100-140 cubic inches (1.6-2.3 liters). This prevents hydraulic fluid loss if there is a leak in the system.

A flow limiter in the up pressure line limits the flow to the nose landing gear actuator to 3 gpm (11 lpm). The flow limiter makes sure hydraulic system pressure stays normal for other airplane systems that also use hydraulic pressure. The flow limiter also controls the transfer cylinder rate and the nose landing gear extension and retraction rate.

Up pressure goes to the transfer cylinder. This moves the piston in the transfer cylinder to the down side. This gives a time delay to let the lock actuator unlock the lock mechanism.

Up pressure also goes to the lock actuator. The lock actuator retracts to unlock the lock mechanism.

When the transfer cylinder piston gets to the end of the down side, up pressure goes to the up side of the gear actuator. The gear actuator applies a retraction force on the nose landing gear and moves it up.

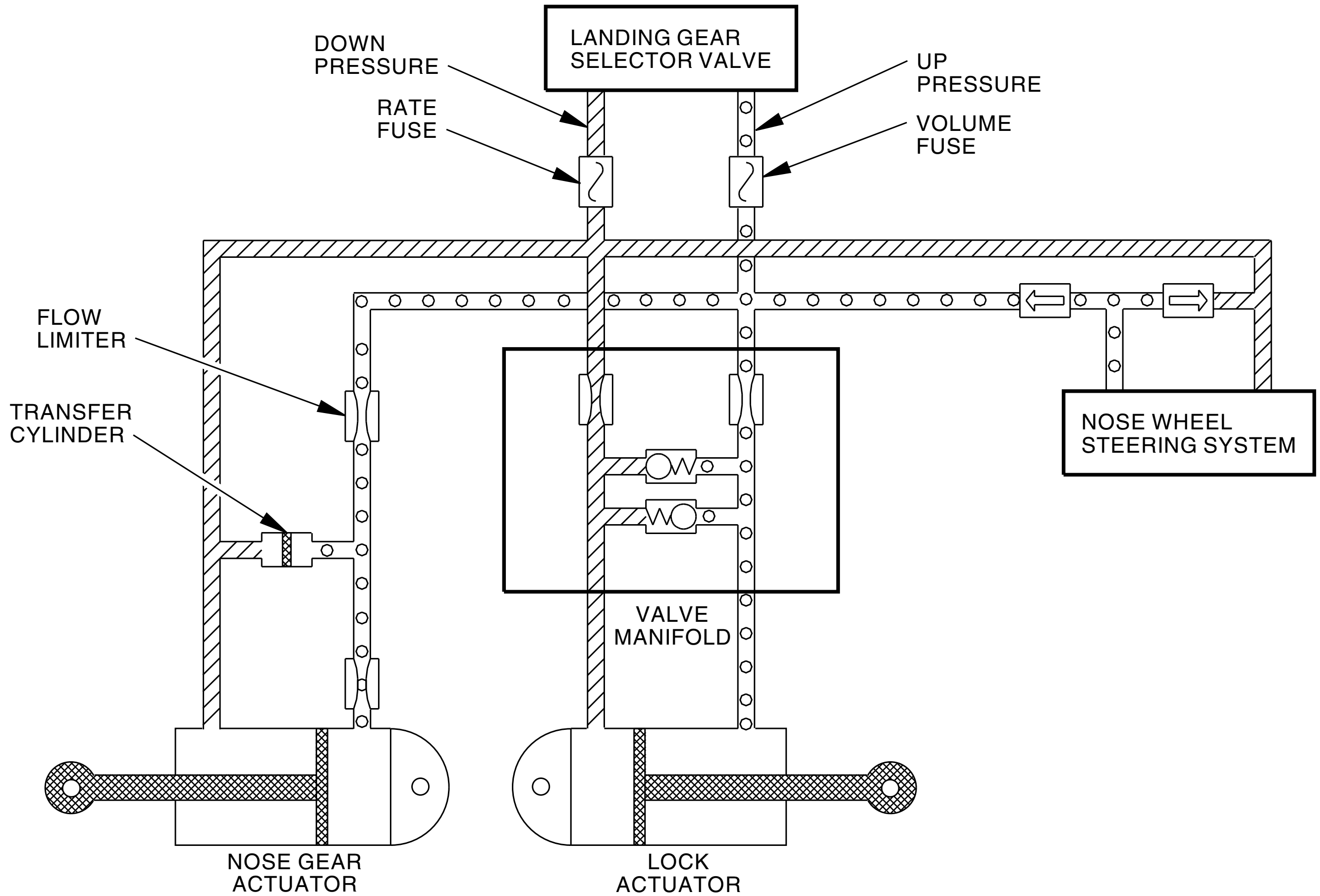
As the nose landing gear moves to the up and locked position, the lock actuator again retracts. This occurs with up pressure to lock the lock mechanism.

Nose Wheel Steering

The nose wheel steering system receives pressure when the landing gear selector valve moves to the down position.

See the Nose Wheel Steering section for more information about nose wheel steering. (SECTION 32-51)

NLG EXTENSION AND RETRACTION - FUNCTIONAL DESCRIPTION



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NLG EXTENSION AND RETRACTION - FUNCTIONAL DESCRIPTION

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MLG MANUAL EXTENSION SYSTEM - GENERAL DESCRIPTION

Purpose

The main landing gear manual extension system lets you lower the left and right main landing gear from the up and locked position. You use the MLG manual extension system when hydraulic system A pressure fails or if normal extension fails.

Components

These are the main landing gear manual extension system components:

- Control mechanism
- Extension linkage
- Control cables (not shown).

General Description

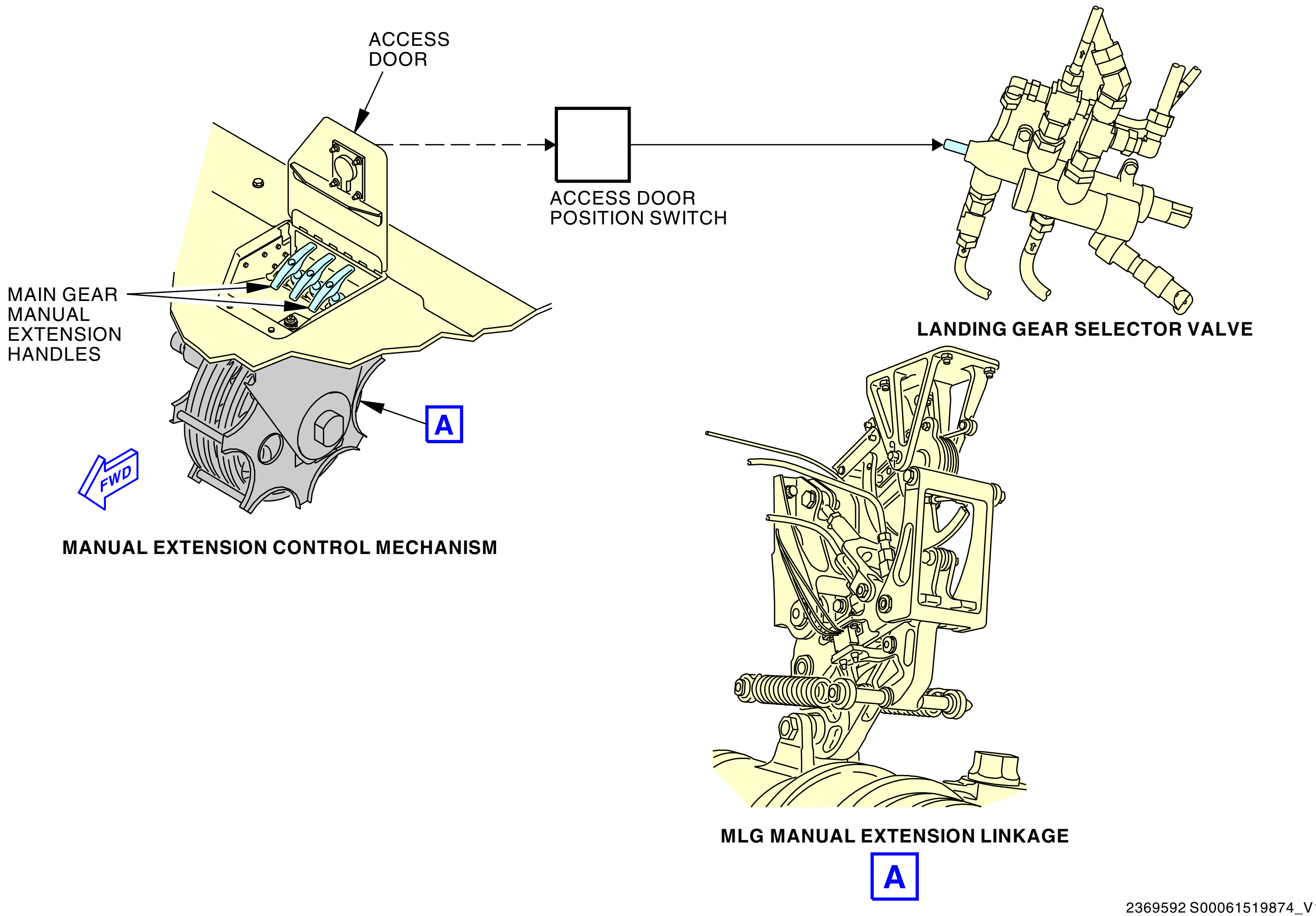
The main landing gear manual extension system operates independently of the normal extension and retraction system.

Pull on either the right main or left main gear manual extension handles in the manual extension control mechanism to operate the system. The handles pull on the right or left MLG manual extension system control cable which goes to the right or left MLG manual extension linkage.

Each MLG manual extension linkage moves the uplock mechanism for that main landing gear to the unlocked position. The main landing gears extend by airloads and their own weight.

When you open the access door to the manual extension control mechanism, an access door position switch sends a signal to the manual extend solenoid valve in the landing gear selector valve. This moves the bypass valve in the landing gear selector valve to connect all the hydraulic components in the normal landing gear extension and retraction system to the hydraulic system return.

MLG MANUAL EXTENSION SYSTEM - GENERAL DESCRIPTION



MLG MANUAL EXTENSION SYSTEM - GENERAL DESCRIPTION

MLG MANUAL EXTENSION SYSTEM - CONTROL MECHANISM

Purpose

The manual extension control mechanism transmits inputs from the flight compartment to the release mechanism of the nose landing gear and extension linkages of the main landing gears.

Location

The manual extension control mechanism is below the flight compartment floor. You get access to the manual extension control mechanism handles through an access door in the floor of the flight compartment aft of the control stand.

Physical Description

There are three manual extension handles. One is for the nose landing gear and one for each main landing gear. They let you operate the manual extension system for each gear. The handles connect to cables that go to cable quadrants.

Functional Description

Manual extension control cables go from each cable quadrant to the release mechanism of the nose landing gear and the extension linkages of the right and left main landing gear.

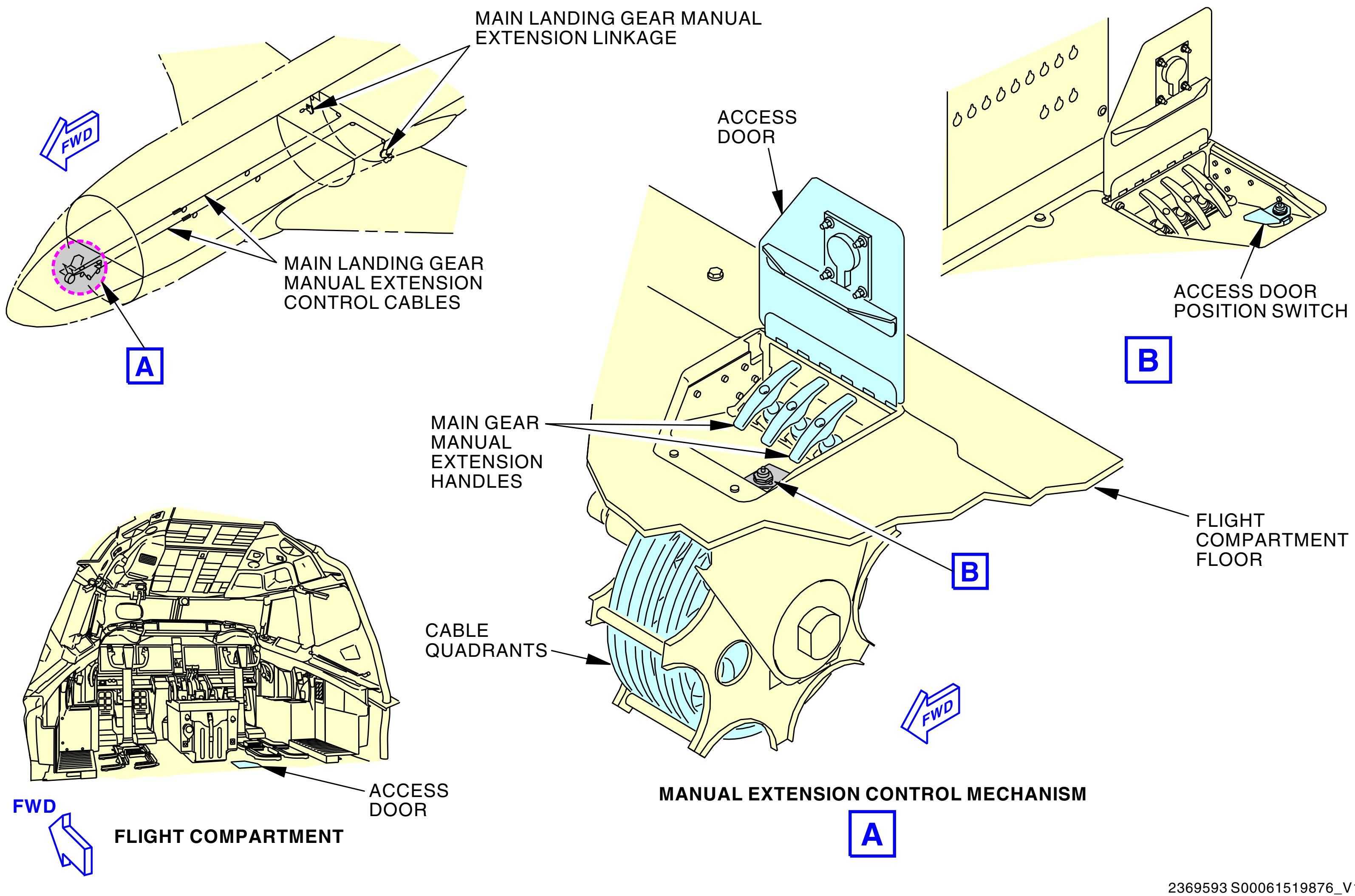
When you open the access door to the manual extension control mechanism, an access door position switch sends a signal to the bypass valve on the landing gear selector valve. The bypass valve moves to the bypass position. This makes sure the landing gear hydraulic components are connected to the hydraulic system return. This prevents a hydraulic lock which may not permit manual extension of the landing gear.

Operation

Pull the right or the left main gear manual extension handles in the manual extension control mechanism to operate the system. This pulls the right or left MLG manual extension cables which go to the right or the left MLG manual extension linkages.

CAUTION DO NOT HOLD THE MANUAL EXTENSION HANDLE IN ANY EXTENDED POSITION DURING HYDRAULIC OPERATION OF THE LANDING GEAR.

MLG MANUAL EXTENSION SYSTEM - CONTROL MECHANISM



MLG MANUAL EXTENSION SYSTEM - CONTROL MECHANISM

MLG MANUAL EXTENSION SYSTEM - MLG EXTENSION LINKAGE

Purpose

The MLG manual extension linkage moves the uplock mechanism to the unlocked position. This lets the MLG extend by gravity during manual extension.

One MLG manual extension linkage operates for each main landing gear.

Location

The MLG manual extension linkage is on the upper bulkhead of the main landing gear wheel well above the uplock mechanism.

Physical Description

The MLG manual extension linkage includes these components:

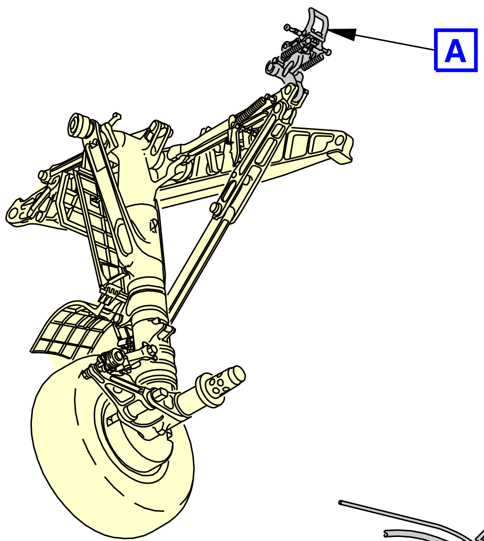
- Quadrant
- Return spring
- Control rod
- Lever
- Upper lock link and tabs
- Lower lock link.

Functional Description

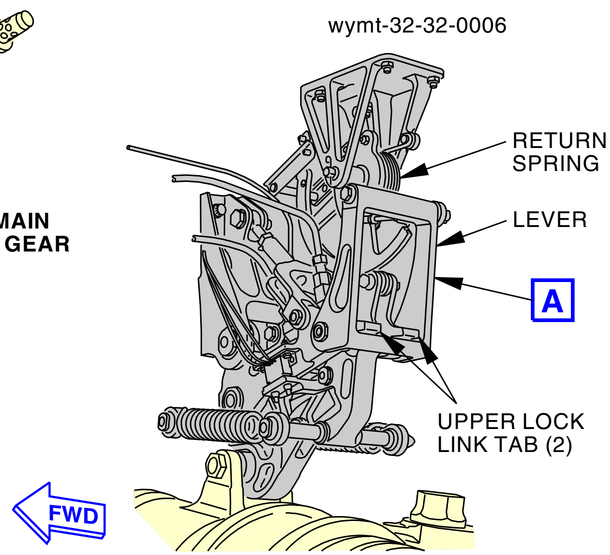
When you pull the main landing gear manual extension handle in the flight compartment, the control cable turns the quadrant in the extension linkage. This pulls the control rod and turns the lever. The lever moves the uplock mechanism (upper and lower lock links) by the upper lock link tabs to the unlocked position.

When you release the manual extension handle, the return spring moves the extension linkage to the normal position.

MLG MANUAL EXTENSION SYSTEM - MLG EXTENSION LINKAGE

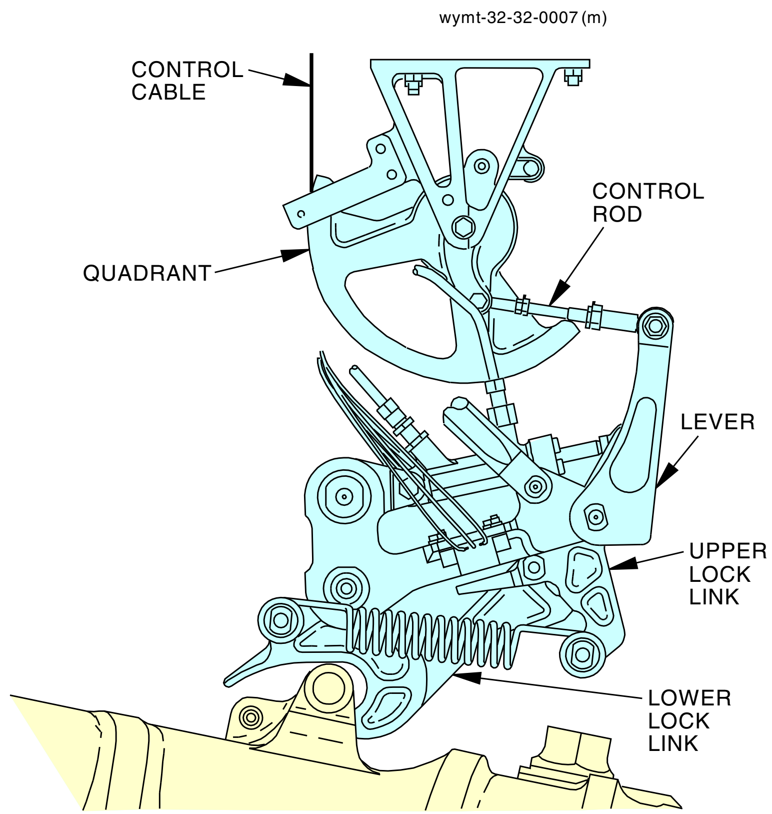


RIGHT MAIN LANDING GEAR



MAIN LANDING GEAR UPLOCK MECHANISM (MLG UP AND LOCKED)

A



MAIN LANDING GEAR MANUAL EXTENSION LINKAGE (LOOKING AFT, MLG UP AND LOCKED)

B

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MLG MANUAL EXTENSION SYSTEM - MLG EXTENSION LINKAGE

MLG MANUAL EXTENSION SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL

General

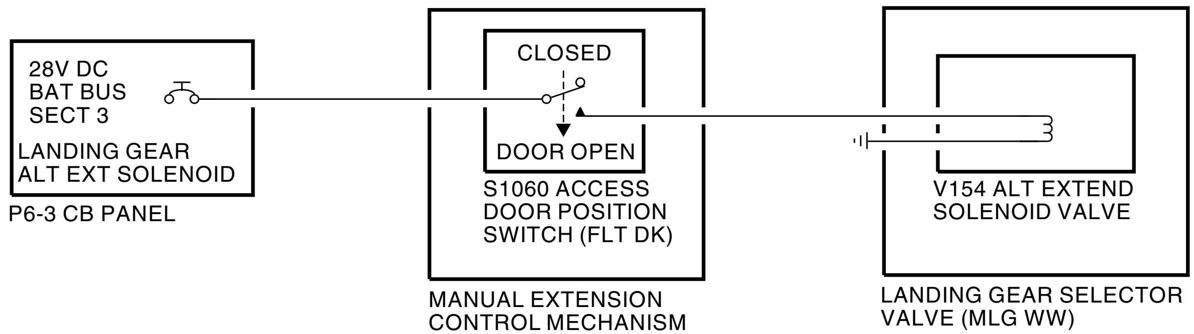
The access door position switch in the manual extension control mechanism sends a signal to the manual extend solenoid valve in the landing gear selector valve. This moves the bypass valve in the landing gear selector valve to connect all hydraulic components in the landing gear system to the hydraulic system return.

Functional Description

When you open the access door to the manual extension control mechanism, an access door position switch closes. The position switch sends 28v dc from the battery bus to the manual extend solenoid valve in the landing gear selector valve. The manual extend solenoid valve commands the bypass valve in the selector valve to move to the bypass position.

See the main landing gear extension and retraction section for more information about the landing gear selector valve. (SECTION 32-32)

MLG MANUAL EXTENSION SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL



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MLG MANUAL EXTENSION SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL

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NLG MANUAL EXTENSION SYSTEM - GENERAL DESCRIPTION

Purpose

The nose landing gear manual extension system lets you lower the nose landing gear from the up and locked position. You use the NLG manual extension system when hydraulic system A pressure fails or if normal extension fails.

Components

These are the nose landing gear manual extension system components:

- Release mechanism
- Control cable (not shown).

General Description

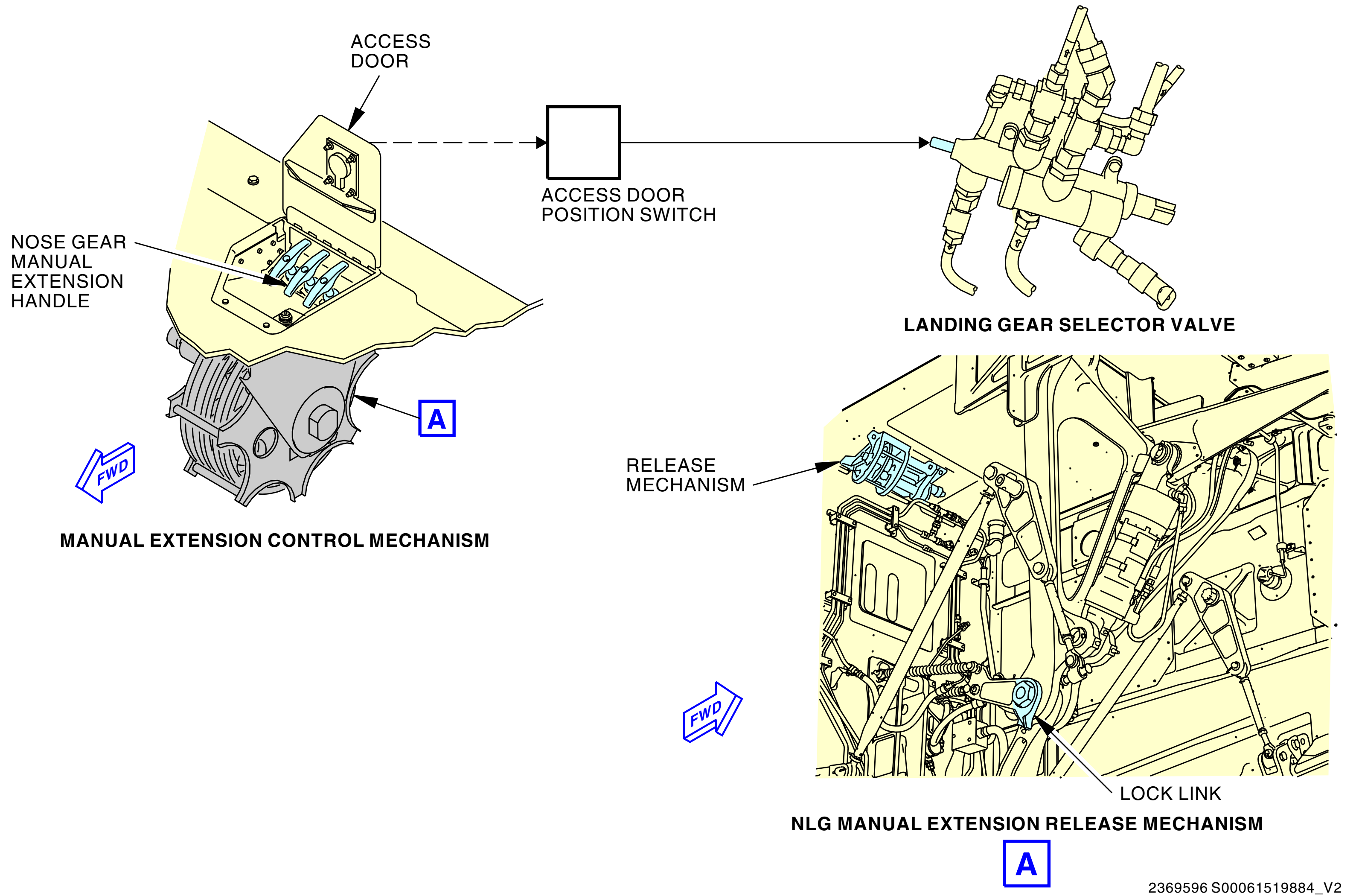
The nose gear manual extension system operates independently of the normal extension and retraction system.

Pull on the nose gear manual extension handle in the manual extension control mechanism to operate the system. This pulls the control cable and turns the release mechanism.

When the release mechanism turns, it moves the nose landing gear lock link to the released position. The nose landing gear extends by airloads and its own weight.

When you open the access door to the manual extension control mechanism, an access door position switch sends a signal to the manual extend solenoid valve in the landing gear selector valve. This moves the bypass valve in the landing gear selector valve to connect all the hydraulic components in the normal landing gear extension and retraction system to the hydraulic system return.

NLG MANUAL EXTENSION SYSTEM - GENERAL DESCRIPTION



NLG MANUAL EXTENSION SYSTEM - GENERAL DESCRIPTION

NLG MANUAL EXTENSION SYSTEM - NLG RELEASE MECHANISM

Purpose

The NLG manual extension release mechanism moves the NLG lock mechanism to the released position. This lets the NLG extend by airloads and gravity.

Location

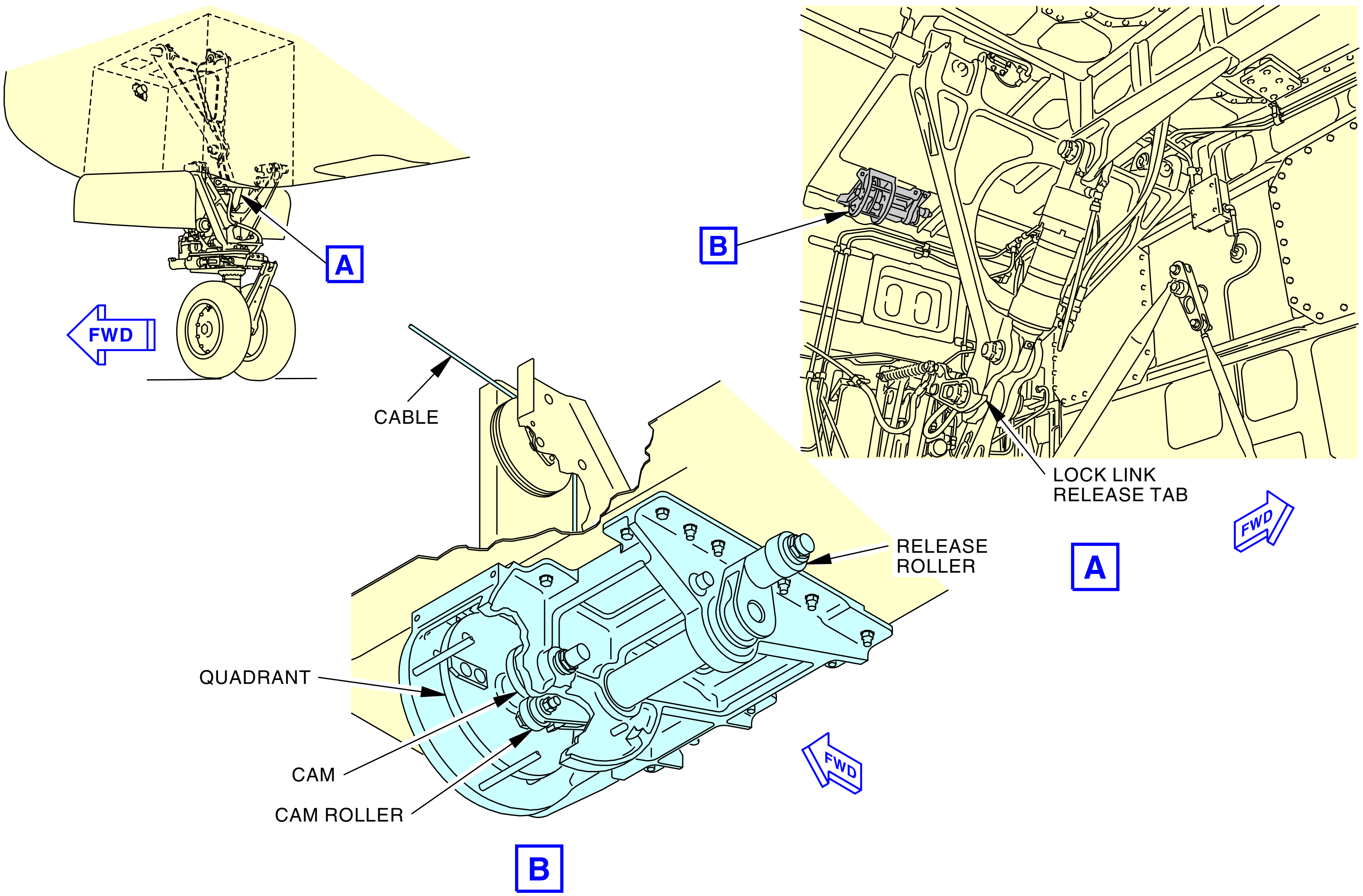
The release mechanism is on the upper bulkhead of the nose landing gear wheel well.

Physical Description

The release mechanism has these components:

- Quadrant
- Cam
- Cam roller
- Release roller.

NLG MANUAL EXTENSION SYSTEM - NLG RELEASE MECHANISM



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NLG MANUAL EXTENSION SYSTEM - NLG RELEASE MECHANISM

NLG MANUAL EXTENSION SYSTEM - FUNCTIONAL DESCRIPTION

General

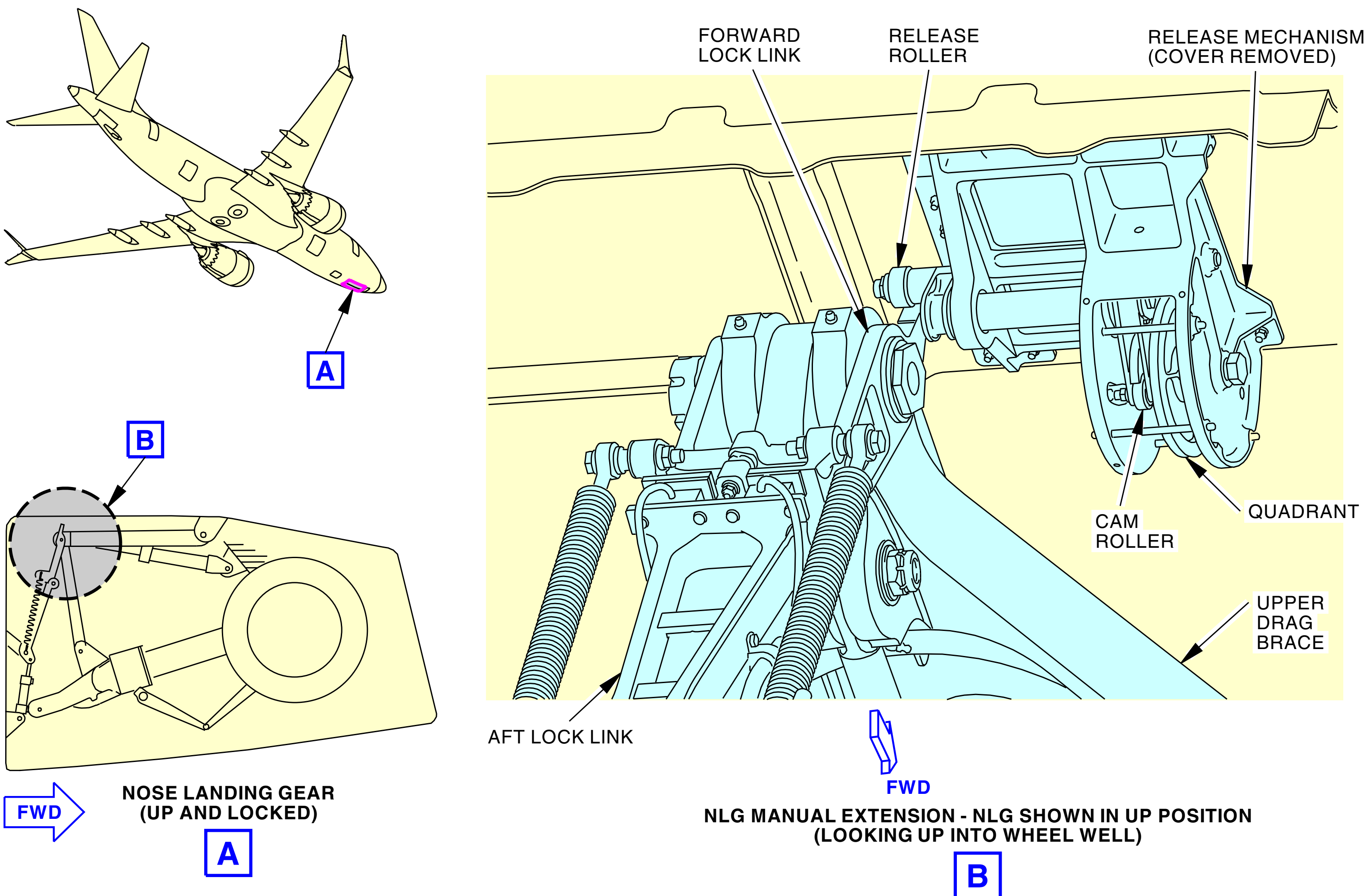
Pull on the NLG manual extension handle in the flight compartment to operate the NLG manual extension system.

Functional Description

When you pull on the handle, the quadrant turns the cam in the release mechanism. The cam operates the cam roller which then turns the release roller forward.

When the release roller rotates forward, it pushes on the forward lock link of the nose landing gear. This unlocks the lock mechanism and the nose landing gear extends to the down and locked position by airloads and gravity.

NLG MANUAL EXTENSION SYSTEM - FUNCTIONAL DESCRIPTION



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NLG MANUAL EXTENSION SYSTEM - FUNCTIONAL DESCRIPTION

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WHEELS AND BRAKES - INTRODUCTION

General

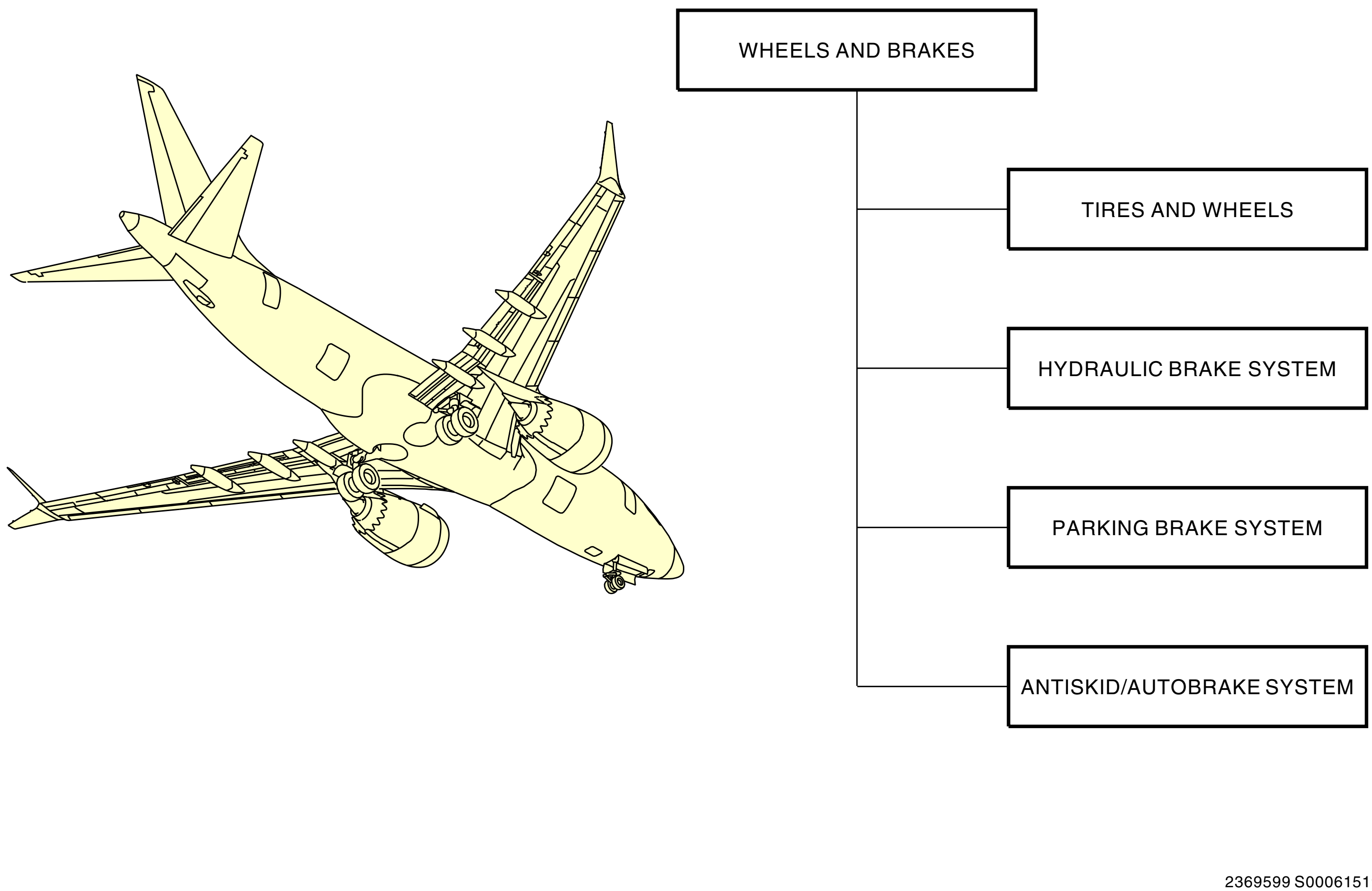
The wheels and brakes system includes these systems:

- Tires and wheels
- Hydraulic brake system
- Parking brake system
- Antiskid/autobrake system.

Abbreviations and Acronyms

- AACU - antiskid/autobrake control unit
- A/B - autobrake
- AC - alternating current
- accum - accumulator
- ADIRU - air data inertial reference unit
- alt - alternate
- bat - battery
- BIT - built-in test
- BITE - bulit-in test equipment
- BMV - brake metering valve
- cont - control
- DC - direct current
- fwd - forward
- gnd - ground
- hyd - hydraulic
- inbd - inboard
- ind - indicator
- inop - inoperative
- kts - knots
- KPA - kilopascals
- L - left
- LG - landing gear
- microsw - microswitch
- MLG - main landing gear
- max - maximum
- NLG - nose landing gear
- norm - normal
- NWS - nose wheel steering
- outbd - outboard
- P - pressure
- PSEU - proximity switch electronics unit
- PSI - pounds per square inch
- R - right
- RTO - rejected takeoff
- sec - seconds
- sol - solenoid
- sw - switch
- sys - system
- vlv - valve
- ww - wheel well

WHEELS AND BRAKES - INTRODUCTION



WHEELS AND BRAKES - INTRODUCTION

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HYDRAULIC BRAKE SYSTEM - GENERAL DESCRIPTION

Purpose

The hydraulic brake system controls hydraulic pressure to the main landing gear brakes.

Brake hydraulic source selection uses the alternate brake selector valve and the accumulator isolation valve to control different pressure sources to supply pressure to these brake functions:

- Normal brakes
- Alternate brakes
- Accumulator brakes.

The brake pedals control the normal and the alternate brake systems.

Components

These are the hydraulic brake system components:

- Brake pedal bus mechanism
- Brake cables (4)
- Brake pressure indicator
- Brake metering valve assembly (2)
- Alternate brake selector valve
- Accumulator isolation valve
- Accumulator
- Accumulator servicing components
- Brake hydraulic fuses (6)
- Brake shuttle valves (4)
- Brake assembly (4)
- Brake system relief valve.

Normal Brakes

If hydraulic system B supplies pressure, the normal brake system uses hydraulic system B pressure to operate the brakes.

Alternate Brakes

The alternate brake system uses hydraulic system A pressure to operate the brakes when hydraulic system B does not supply pressure.

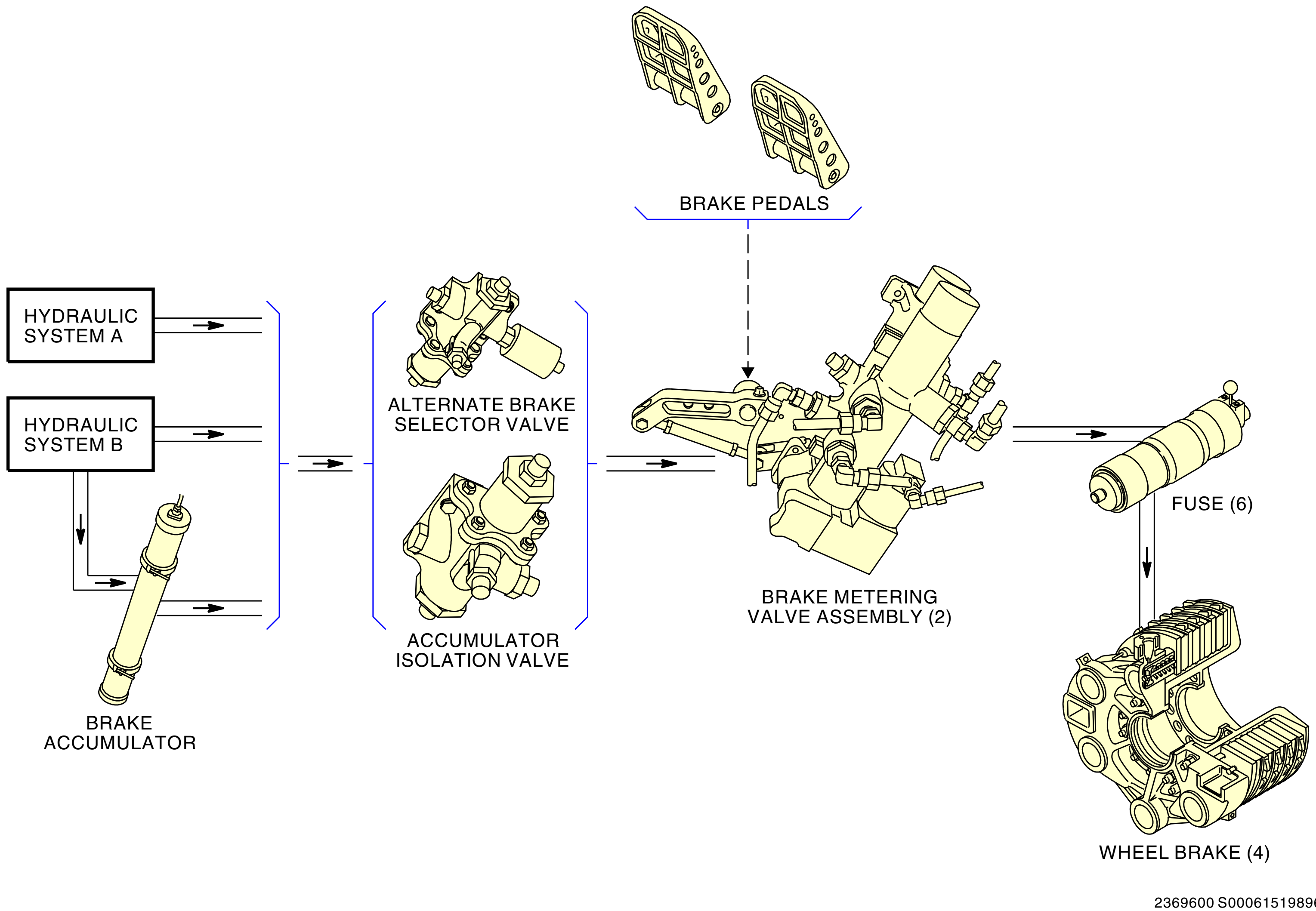
Accumulator Brakes

When the hydraulic systems A and B do not supply pressure, the brake accumulator supplies pressure to the normal brake system.

Gear Retract Brakes

During landing gear retraction, the alternate brake system gets pressure to operate the brakes. This stops wheel rotation before the landing gear retracts.

HYDRAULIC BRAKE SYSTEM - GENERAL DESCRIPTION



HYDRAULIC BRAKE SYSTEM - GENERAL DESCRIPTION

HYDRAULIC BRAKE SYSTEM - COMPONENT LOCATION

Flight Compartment Components

The hydraulic brake system includes these components on or near the flight compartment:

- Brake pedal bus mechanism
- Brake cables
- Hydraulic brake pressure indicator.

Brake Pedal Bus Mechanism

Most of the brake pedal bus mechanism components are below the flight compartment floor. You get access to these components from the forward equipment compartment.

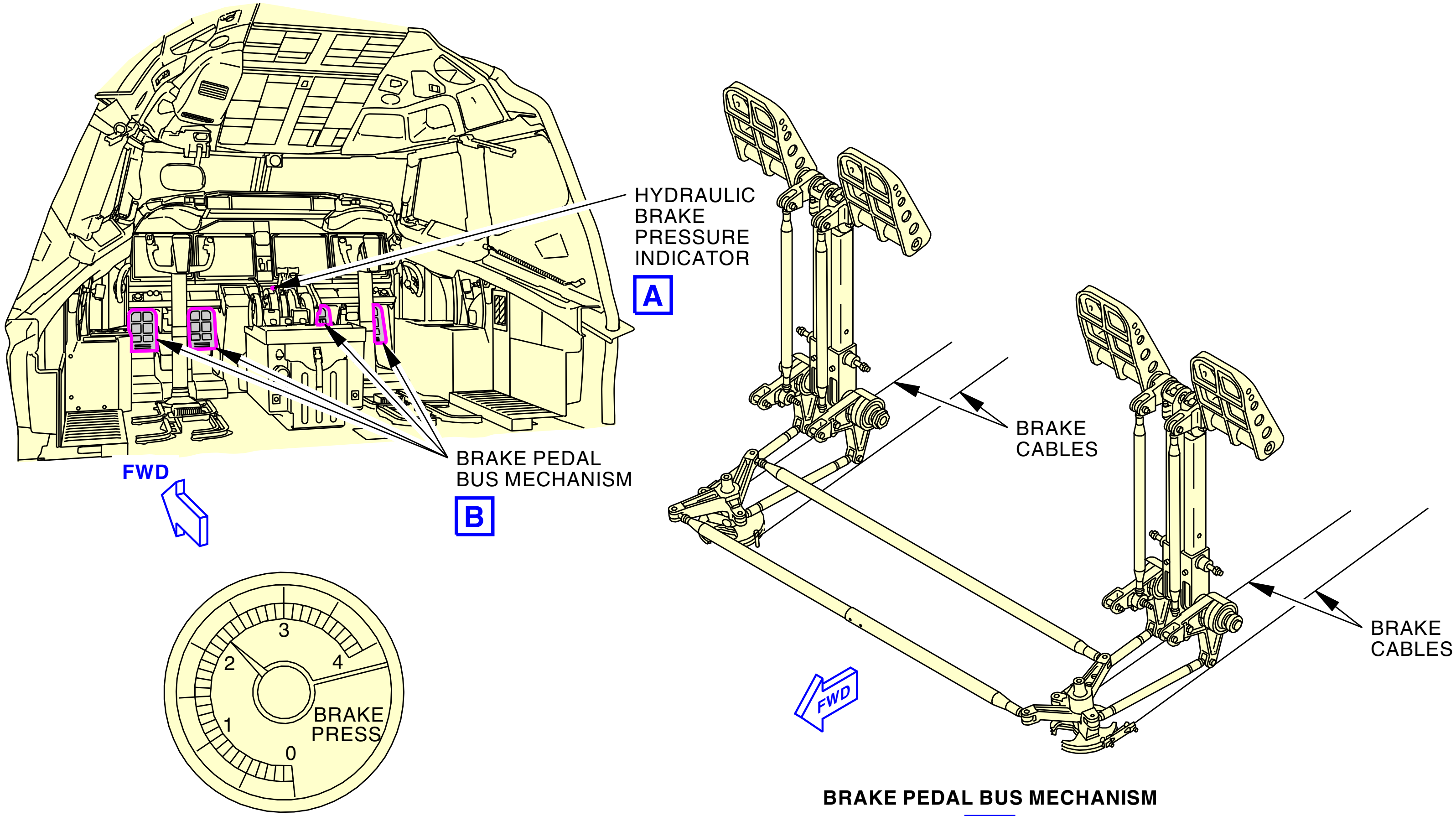
Brake Cables

Brake cables connect the brake pedal bus mechanism to the brake metering valves in the main landing gear wheel well. You get access to these components from the forward equipment compartment and below the flight compartment floor.

Hydraulic Brake Pressure Indicator

The hydraulic brake pressure indicator is on the P3 first officer instrument panel.

HYDRAULIC BRAKE SYSTEM - COMPONENT LOCATION



HYDRAULIC BRAKE PRESSURE INDICATOR

A

BRAKE PEDAL BUS MECHANISM

B

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HYDRAULIC BRAKE SYSTEM - COMPONENT LOCATION

HYDRAULIC BRAKE SYSTEM - BRAKE PEDAL BUS MECHANISM

Purpose

The brake pedal mechanism sends brake pedal inputs to the brake metering valves to manually control brake metered pressure.

Components

These are the brake pedal mechanism components:

- Captain and first officer rudder pedals
- Vertical controls rods (4)
- Lower bellcranks (4)
- Fore-aft control rods (4)
- Brake pedal bus crank assemblies (2)
- Cable quadrants (2)
- Bus rods (2)
- Brake cables (4).

Location

The rudder pedals and vertical control rods are above the flight compartment floor. The vertical control rods extend through the floor into the forward equipment compartment. All of the other components are in the forward equipment compartment.

The brake cables attach to the brake pedal mechanism cable quadrants and go to the main landing gear wheel well.

Functional Description

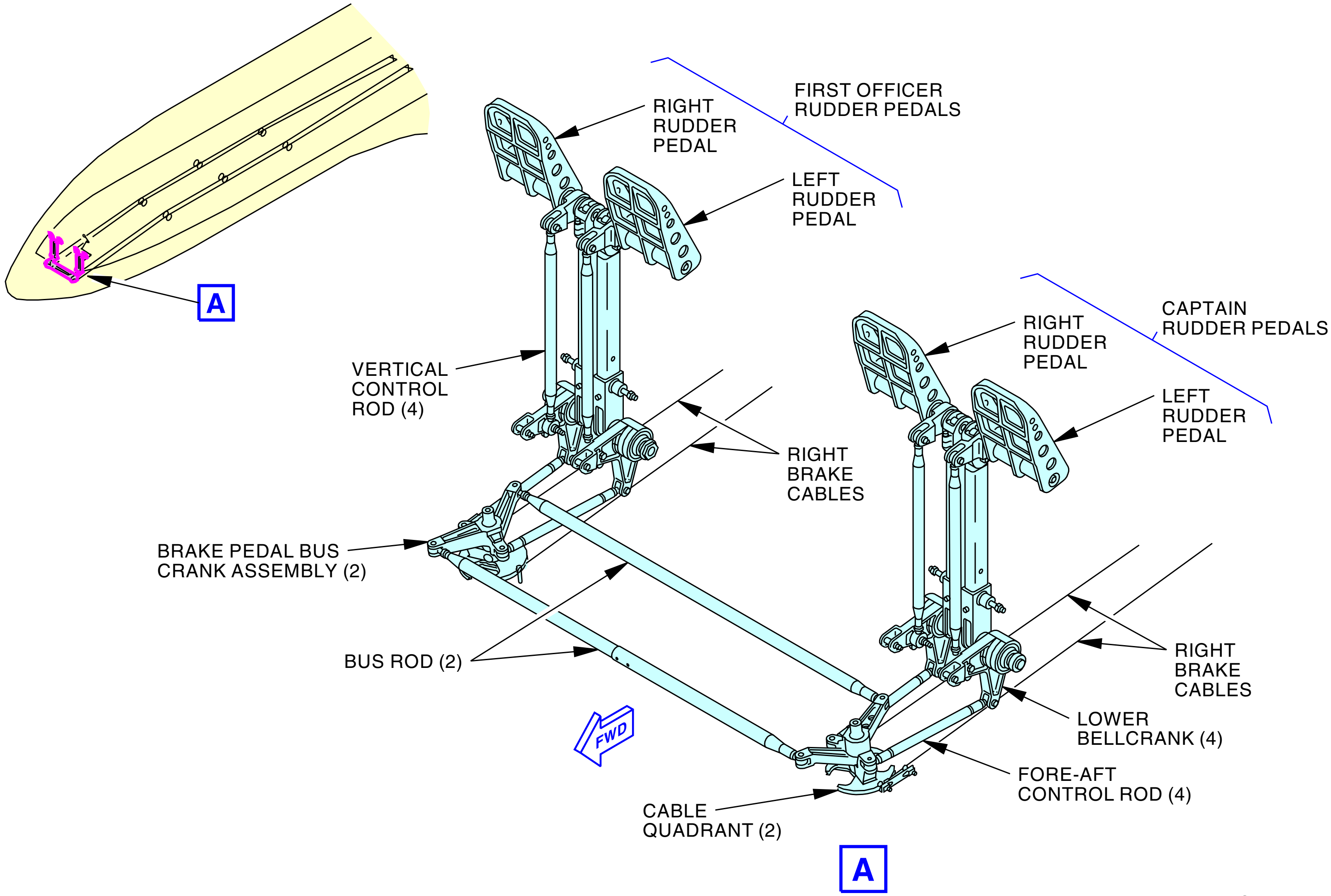
Two sets of brake pedals operate the brake pedal bus mechanism.

Pedal movement goes through vertical control rods to the lower bellcranks. These bellcranks connect to brake pedal bus crank assemblies and cable quadrants with fore-aft control rods.

Input to the left cable quadrant controls the left brakes with brake cables on the left side of the airplane. The right cable quadrant and cables are on the right side of the airplane and operate the same as the left.

Bus rods connect the left and right brake pedal bus crank assemblies. This permits control of the left and right brakes with the captain or the first officer pedals.

HYDRAULIC BRAKE SYSTEM - BRAKE PEDAL BUS MECHANISM



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HYDRAULIC BRAKE SYSTEM - BRAKE PEDAL BUS MECHANISM

HYDRAULIC BRAKE SYSTEM - BRAKE METERING VALVE ASSEMBLY

Purpose

The brake metering valve assemblies get input from the brake pedals through control cables and a control quadrant that operate a crank and control rod. Movement of the brake pedal mechanism controls the brake metering valves that send out metered brake pressure to the brakes.

location

There are two brake metering valve assemblies in the main landing gear wheel well on the aft side of the ceiling.

Physical Description

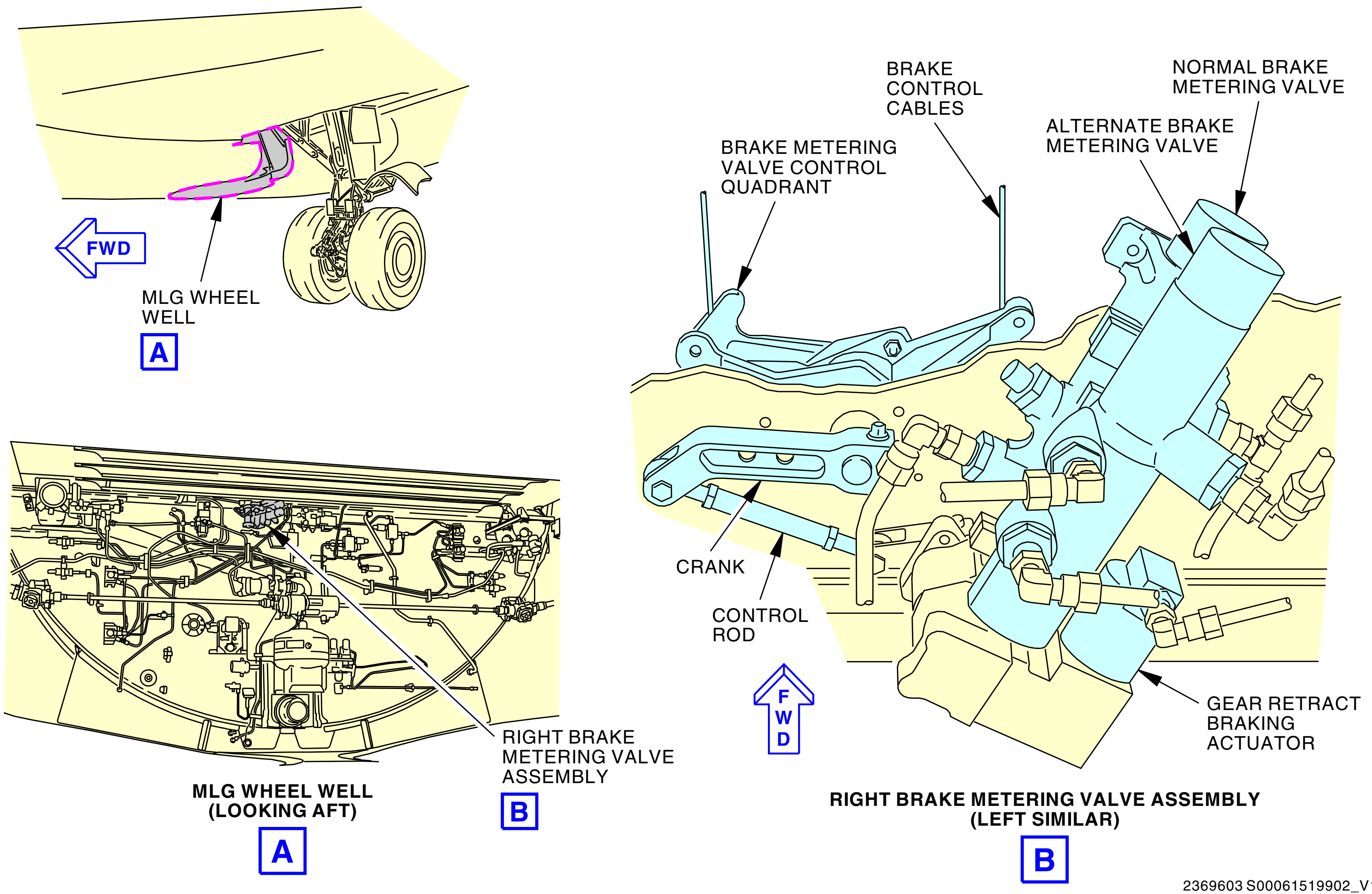
The brake metering valve assemblies are interchangeable and have these components:

- Normal metering valve
- Alternate metering valve
- Gear retract braking actuator.

The normal and alternate metering valve have identical housings that are bolted together and share a common input shaft.

The gear retract braking actuators are mounted integrally with the alternate metering valve.

HYDRAULIC BRAKE SYSTEM - BRAKE METERING VALVE ASSEMBLY



HYDRAULIC BRAKE SYSTEM - BRAKE METERING VALVE ASSEMBLY

HYDRAULIC BRAKE SYSTEM - BRAKE METERING VALVE ASSEMBLY - FUNCTIONAL DESCRIPTION

General

On the brake metering valve assembly, the normal and alternate brake metering valves are almost the same. They attach together and use the same input shaft.

Only one valve at a time gets pressure, except during gear retract braking. The alternate brake selector valve and accumulator isolation valve control which metering valve gets pressure.

The normal brake metering valve uses hydraulic system B or accumulator pressure for the normal brake system.

The alternate brake metering valve uses hydraulic system A pressure for the alternate brake system when hydraulic system B does not supply pressure. It also uses pressure from the landing gear retract line to stop the main gear wheel rotation during retraction.

Normal and Alternate Brake Application

The brake pedal command goes to the metering valves through cables and linkage. This moves the metering valve input shaft.

When the input shaft turns, it moves the metering valve spools in both valves at the same time.

The metering valve spools are spring-loaded to the brakes OFF position.

Metering valve spool movement sends pressure to the brakes and to the feedback chamber. This pressure applies the brakes and moves the metering valve spool to the brake pressure maintained position. This also applies a feedback force back through the brake control cables to the brake pedals.

Brake pedal release lets the springs return the metering valve spools in both valves to the closed position. This sends brake pressure to return and releases the brakes.

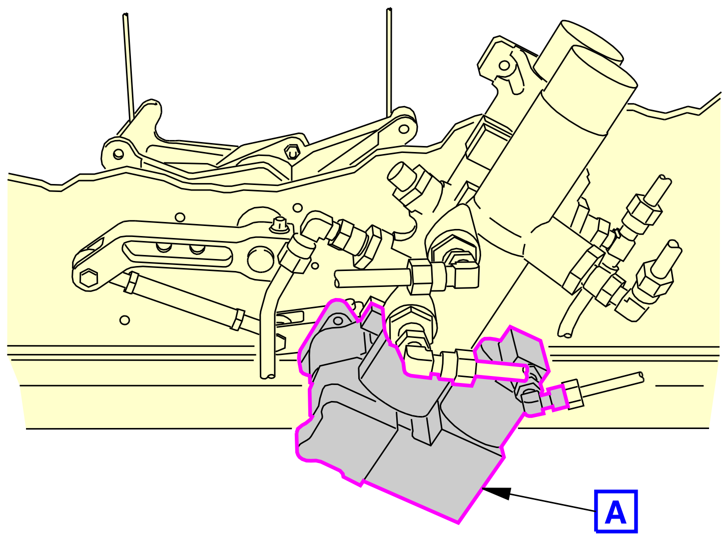
Gear Retract Wheel Braking

During landing gear retraction, landing gear retract pressure from the landing gear selector valve pressurizes the gear retract braking actuator.

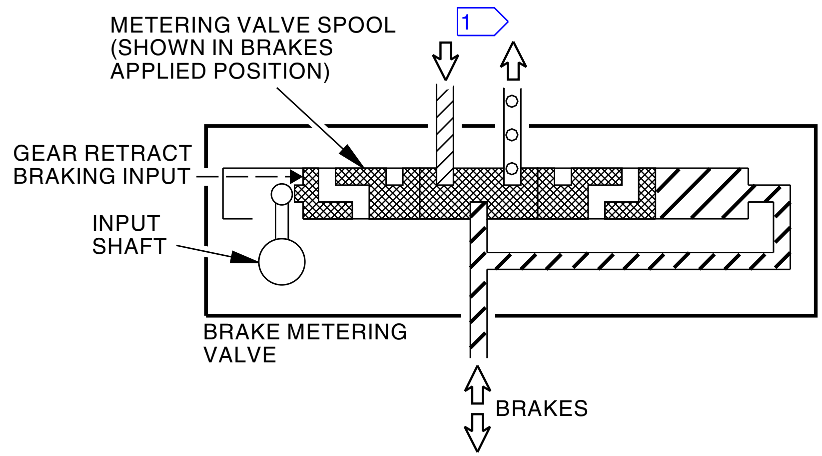
The gear retract braking actuator moves a forked actuator lever to operate the alternate brake metering valve spool. This operation does not move the input shaft and does not move the brake pedals.

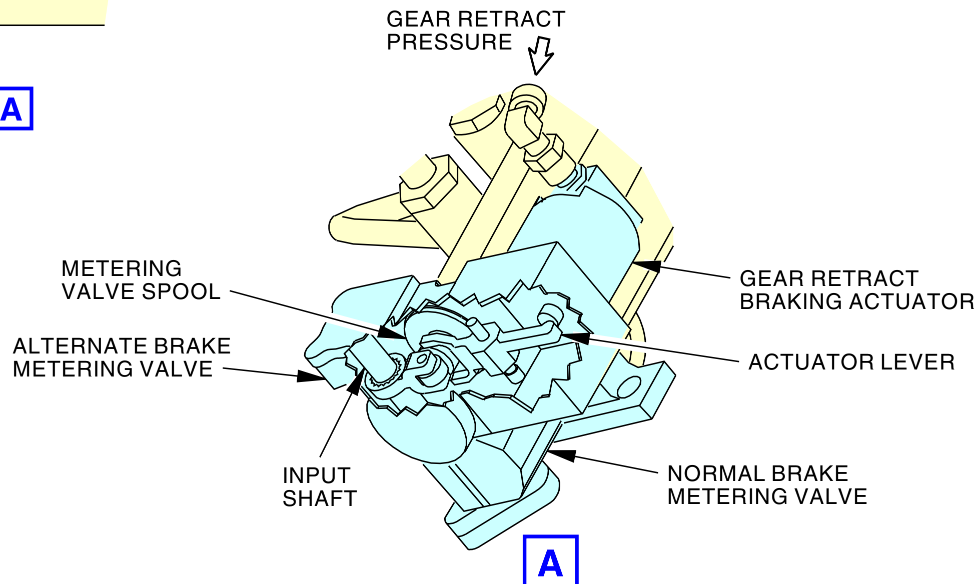
The movement of the alternate metering valve spool sends landing gear retract pressure to the brakes.

HYDRAULIC BRAKE SYSTEM - BRAKE METERING VALVE ASSEMBLY - FUNCTIONAL DESCRIPTION



BRAKE METERING VALVES





LEGEND:

RETURN

PRESSURE (SYSTEM)

PRESSURE (METERED)

1 - HYDRAULIC SYSTEM B OR BRAKE ACCUMULATOR (NORMAL BRAKE METERING VALVE)

- HYDRAULIC SYSTEM A (ALTERNATE BRAKE METERING VALVE)

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HYDRAULIC BRAKE SYSTEM - BRAKE METERING VALVE ASSEMBLY - FUNCTIONAL DESCRIPTION

HYDRAULIC BRAKE SYSTEM - ALTERNATE BRAKE SELECTOR AND ACCUMULATOR ISOLATION VALVES

Purpose

The alternate brake selector valve selects and sends hydraulic systems B or A pressure to the normal or alternate brake systems.

The accumulator isolation valve holds pressure in the brake accumulator when the alternate brake system gets pressure.

Location

Both valves are in the main landing gear wheel well on the upper bulkhead.

Physical Description

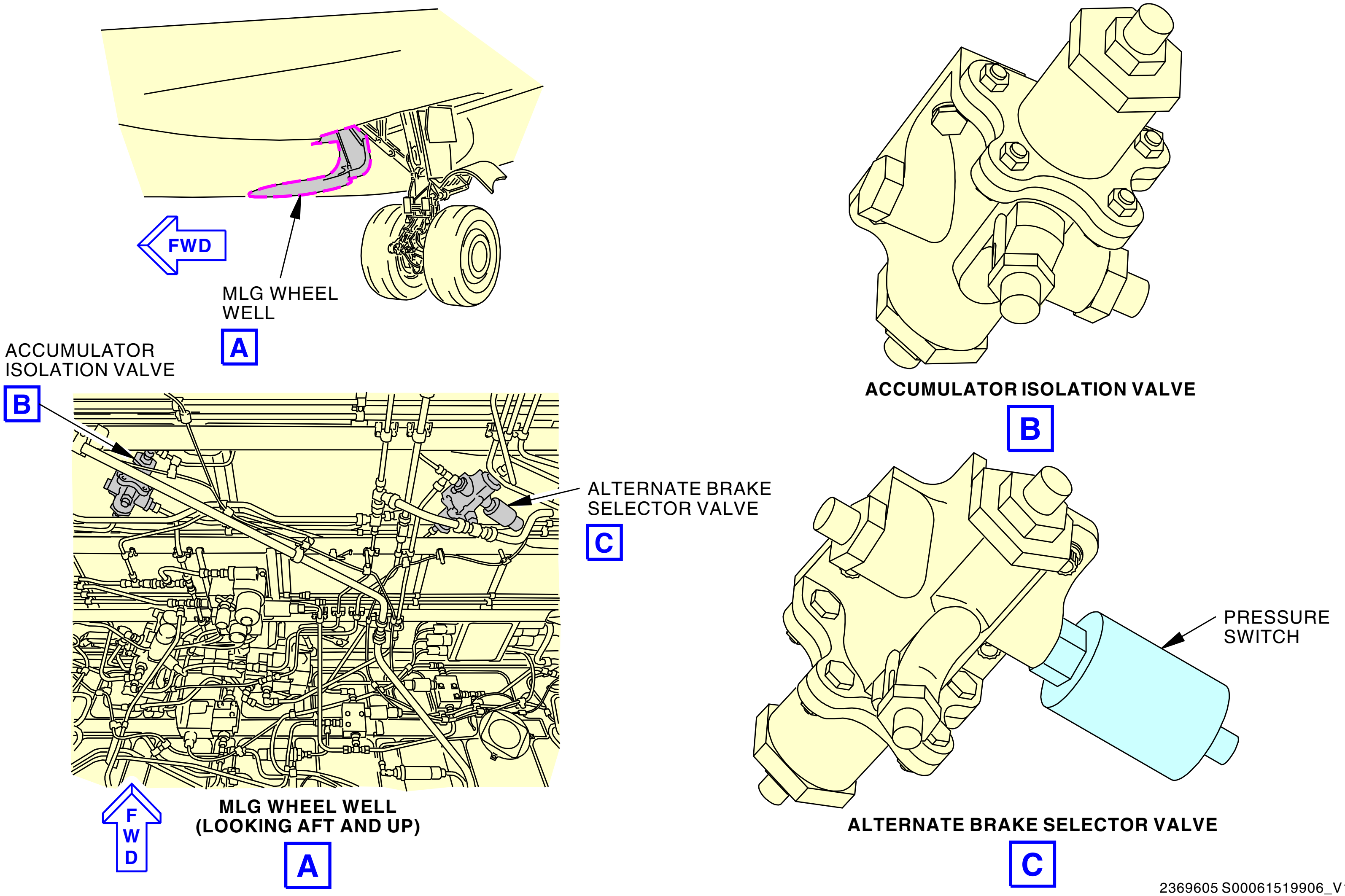
The each valve is a two-position valve with these components:

- Housing
- Slide valve
- Pressure switch (alternate brake selector valve only).

Both valves are the same and are interchangeable except for a pressure switch on the alternate brake selector valve.

Each valve gets pressure from two sources. The pressures push on pistons in the valves that have different surface areas. This moves the valves to select the brake source.

HYDRAULIC BRAKE SYSTEM - ALTERNATE BRAKE SELECTOR AND ACCUMULATOR ISOLATION VALVES



HYDRAULIC BRAKE SYSTEM - ALTERNATE BRAKE SELECTOR AND ACCUMULATOR ISOLATION VALVES

HYDRAULIC BRAKE SYSTEM - ALT BRAKE SELECTOR AND ACCUM ISOLATION VALVES - FUNCTIONAL DESCRIPTION

General

The alternate brake selector and accumulator isolation valves operate together to control pressure to the normal and alternate brake systems.

Alternate Brake Selector Valve

When hydraulic system A and B pressures are the same, hydraulic system B pressure on the alternate brake selector valve does not let hydraulic system A supply pressure to the alternate brake system. In this position, the alternate brake selector valve lets landing gear retract pressure pressurize the alternate brake system during gear retraction.

When hydraulic system B does not supply pressure, the alternate brake selector valve moves. This lets hydraulic system A pressure supply pressure to the alternate brake system.

The alternate brake selector valve pressure switch sends a signal to the antiskid system when the alternate brake system receives pressure.

See the antiskid/autobrake system for more information about the anitskid system. (SECTION 32-42)

The pressure switch also sends a signals to the flight data acquisition unit (FDAU).

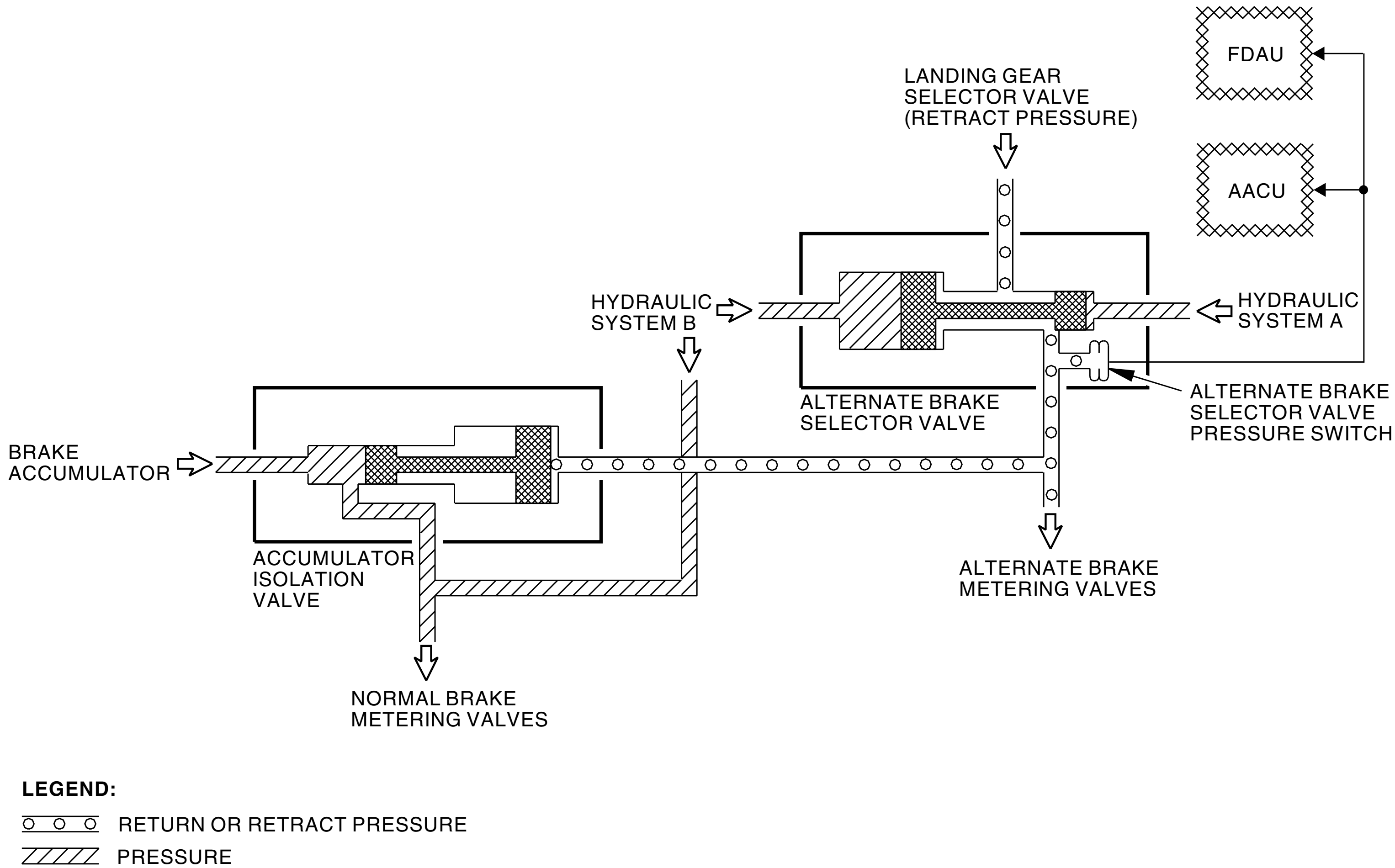
See the Flight Data Recording System (FDRS) section for more information on the flight data acquisition unit. (SECTION 31-31)

Accumulator Isolation Valve

When hydraulic system B does not supply pressure, alternate brake system pressure from the alternate brake selector valve moves the accumulator isolation valve. This isolates brake accumulator pressure from the normal brake system.

When hydraulic system B and A do not supply pressure, brake accumulator pressure moves the accumulator isolation valve. This sends pressure from the brake accumulator to the normal brake system.

HYDRAULIC BRAKE SYSTEM - ALT BRAKE SELECTOR AND ACCUM ISOLATION VALVES - FUNCTIONAL DESCRIPTION



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HYDRAULIC BRAKE SYSTEM - ALT BRAKE SELECTOR AND ACCUM ISOLATION VALVES - FUNCTIONAL DESCRIPTION

HYDRAULIC BRAKE SYSTEM - BRAKE ACCUMULATOR

Purpose

The brake accumulator supplies brake pressure to the normal brake hydraulic system if there are no other pressure sources. It is also the pressure source for the parking brake system when the hydraulic systems do not supply pressure.

Location

The brake accumulator is in the right aft wing-to-body fairing. To get access to the brake accumulator, open the hinged door on the bottom of the fairing.

The servicing components are on the aft bulkhead in the main landing gear wheel well.

Physical Description

Brake accumulator and servicing components include:

- Brake accumulator
- Inflation valve
- Pressure transmitter
- Pressure indicator
- Brake pressure relief valve.

Functional Description

The accumulator is a gas charged unit with a floating piston that separates the gas and the fluid. It has a precharge of 1000 psi and a volume of 300 cubic inches (4.9 liters). Hydraulic system B supplies pressure to the accumulator.

The brake accumulator pressure transmitter sends the pressure signal to the brake pressure indicator in the flight compartment.

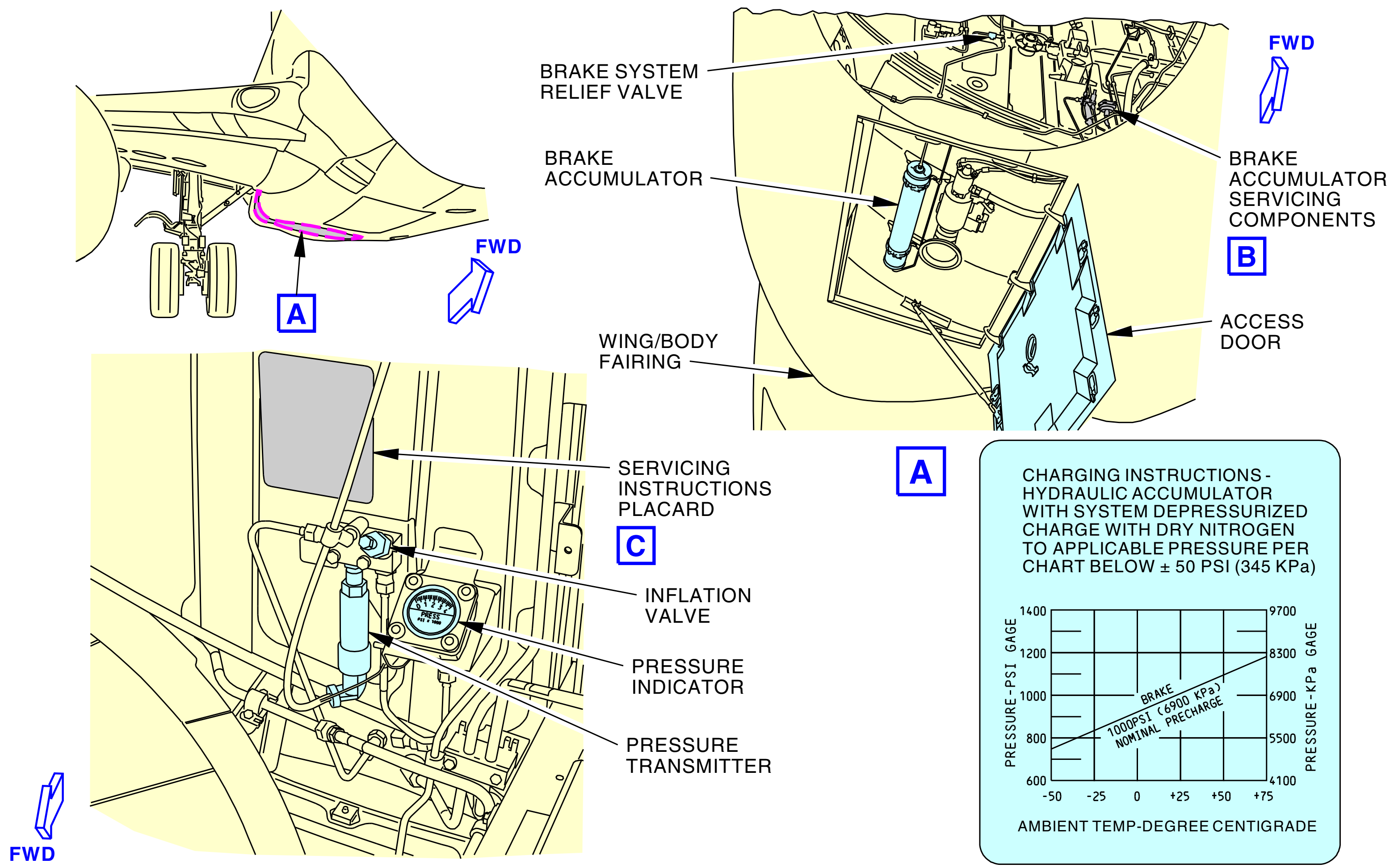
The direct reading pressure indicator in the main landing gear wheel well lets you see the accumulator pressure while you service the accumulator.

Servicing instructions are on a placard by the charging valve and transmitter.

When the accumulator is fully charged, it supplies enough pressure for at least six full brake applications or to keep the parking brake pressurized for eight hours.

The brake system relief valve opens when the pressure in the brake accumulator increases to more than 3500 psi. This prevents damage to the brake accumulator. The relief valve closes when the pressure decreases to less than 3100 psi.

HYDRAULIC BRAKE SYSTEM - BRAKE ACCUMULATOR



BRAKE ACCUMULATOR SERVICING COMPONENTS

B

SERVICING INSTRUCTIONS PLACARD

C

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HYDRAULIC BRAKE SYSTEM - BRAKE ACCUMULATOR

HYDRAULIC BRAKE SYSTEM - BRAKE HYDRAULIC FUSES

Purpose

Brake hydraulic fuses prevent hydraulic fluid loss if there is an external leak downstream of the fuses.

Four hydraulic fuses in the normal brake lines protect each brake during normal brake operation. Two hydraulic fuses in the alternate brake lines each protect both brakes on a main landing gear during alternate brake operation.

Location

The brake hydraulic fuses for the normal brake system are on the aft bulkhead of the main landing gear wheel well.

The brake hydraulic fuses for the alternate brake system are on the outboard sides of the upper bulkhead of the main landing gear wheel well.

Physical Description

The brake hydraulic fuse is a volume type and has these components:

- Housing
- Spring
- Piston
- Metering slot
- Manual bypass valve.

Functional Description

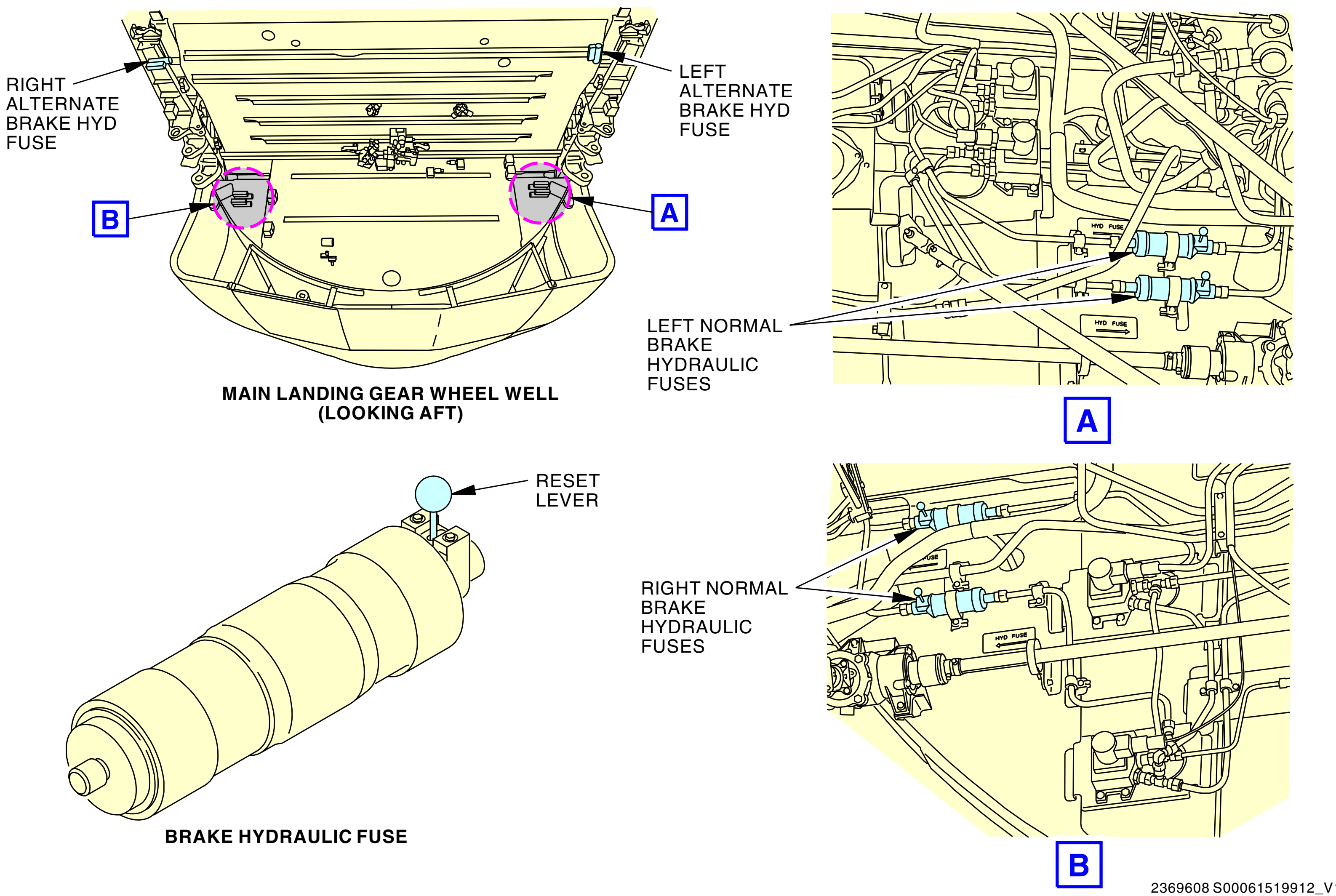
During normal operation, the piston and spring are at the relaxed position. This lets fluid pressure go through the metering slot and over the bypass valve normally. When the pressure differential across the fuse starts to decrease below normal, the piston starts to compress the spring.

If 60 to 95 cubic inches (0.9-1.5 liters) of fluid goes through the hydraulic fuse metering slot and bypass valve, the piston compresses the spring until the fuse is closed. When the pressure differential across the hydraulic fuse decreases between 0 and 30 psi, the fuse resets. This lets the spring push the piston to the normal position.

A reset lever permits manual reset of the hydraulic fuse. To reset the hydraulic fuse, move the reset lever in the direction shown on the placard near the fuse. This operates a bypass valve inside the hydraulic fuse that makes the pressure on each side of the fuse equal.

There are no visual indications of a closed fuse.

HYDRAULIC BRAKE SYSTEM - BRAKE HYDRAULIC FUSES



HYDRAULIC BRAKE SYSTEM - BRAKE HYDRAULIC FUSES

HYDRAULIC BRAKE SYSTEM - BRAKE SHUTTLE VALVES

Purpose

The brake shuttle valves select the highest of normal/autobrake or alternate/gear retract pressures and sends it to the brakes.

Location

The brake shuttle valves are on the outboard sides of the ceiling in the main landing gear wheel well.

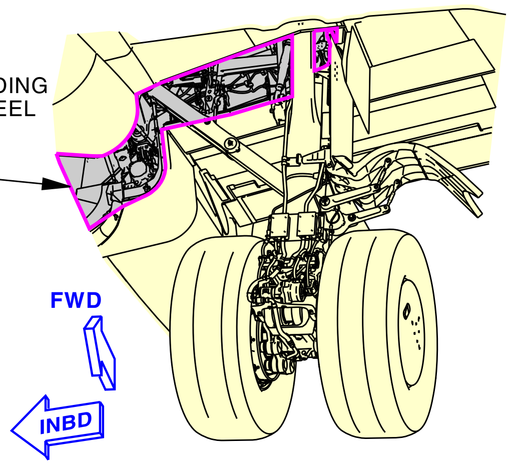
Physical Description

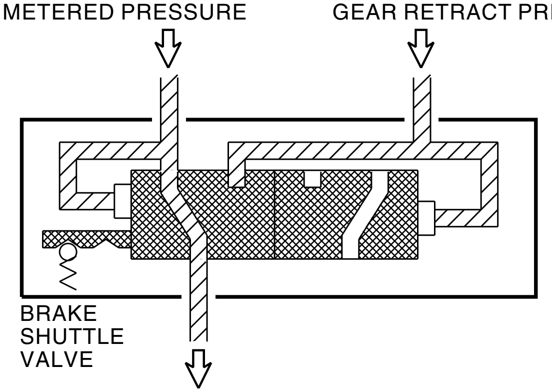
The shuttle valves are un-biased valves with a shuttle piston and a spring detent. The valves are interchangeable.

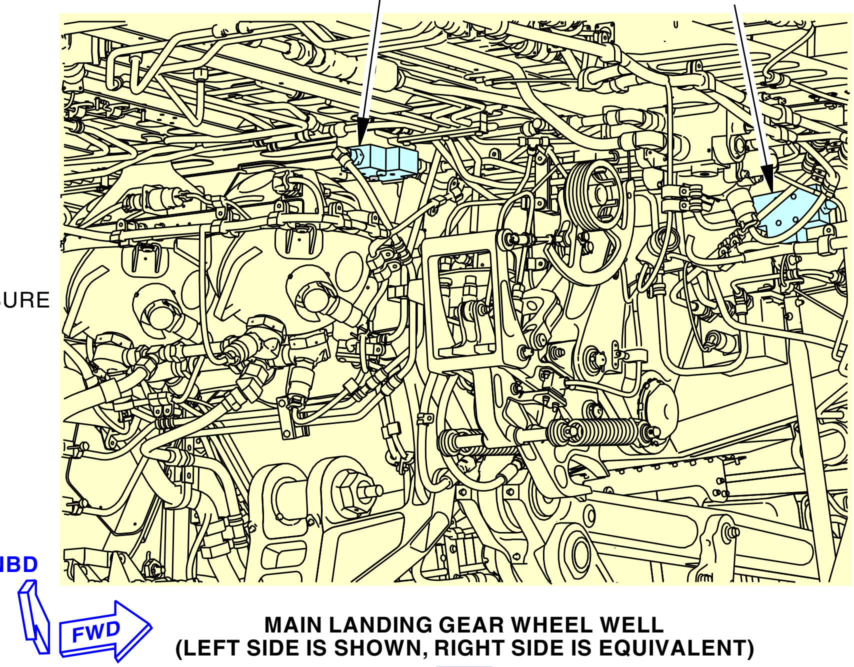
Functional Description

The shuttle piston moves to the detented position when a pressure differential between the two input pressure source lines increases to 80 psi or more. This connects the input line with the highest metered pressure to the brake line. The shuttle piston also blocks the line that has the lowest pressure.

HYDRAULIC BRAKE SYSTEM - BRAKE SHUTTLE VALVES







MAIN LANDING GEAR WHEEL WELL
(LEFT SIDE IS SHOWN, RIGHT SIDE IS EQUIVALENT)

A

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HYDRAULIC BRAKE SYSTEM - BRAKE SHUTTLE VALVES

HYDRAULIC BRAKE SYSTEM - BRAKE ASSEMBLY

General

The main landing gear wheel brakes use hydraulic pressure to slow or stop the airplane during landing and taxi.

Location

Each wheel brake is on a main landing gear axle.

Physical Description

The brake assembly is a rotor-stator unit that operates using hydraulic pressure. The assembly uses multiple carbon discs as rotors and stators.

Each main landing gear wheel brake has these components:

- Stators
- Rotors
- Pressure Plate
- Piston/adjusters (6)
- Axle bushings
- Wear indicator pins (2)
- Brake hose connection/hydraulic bleed port.

Functional Description

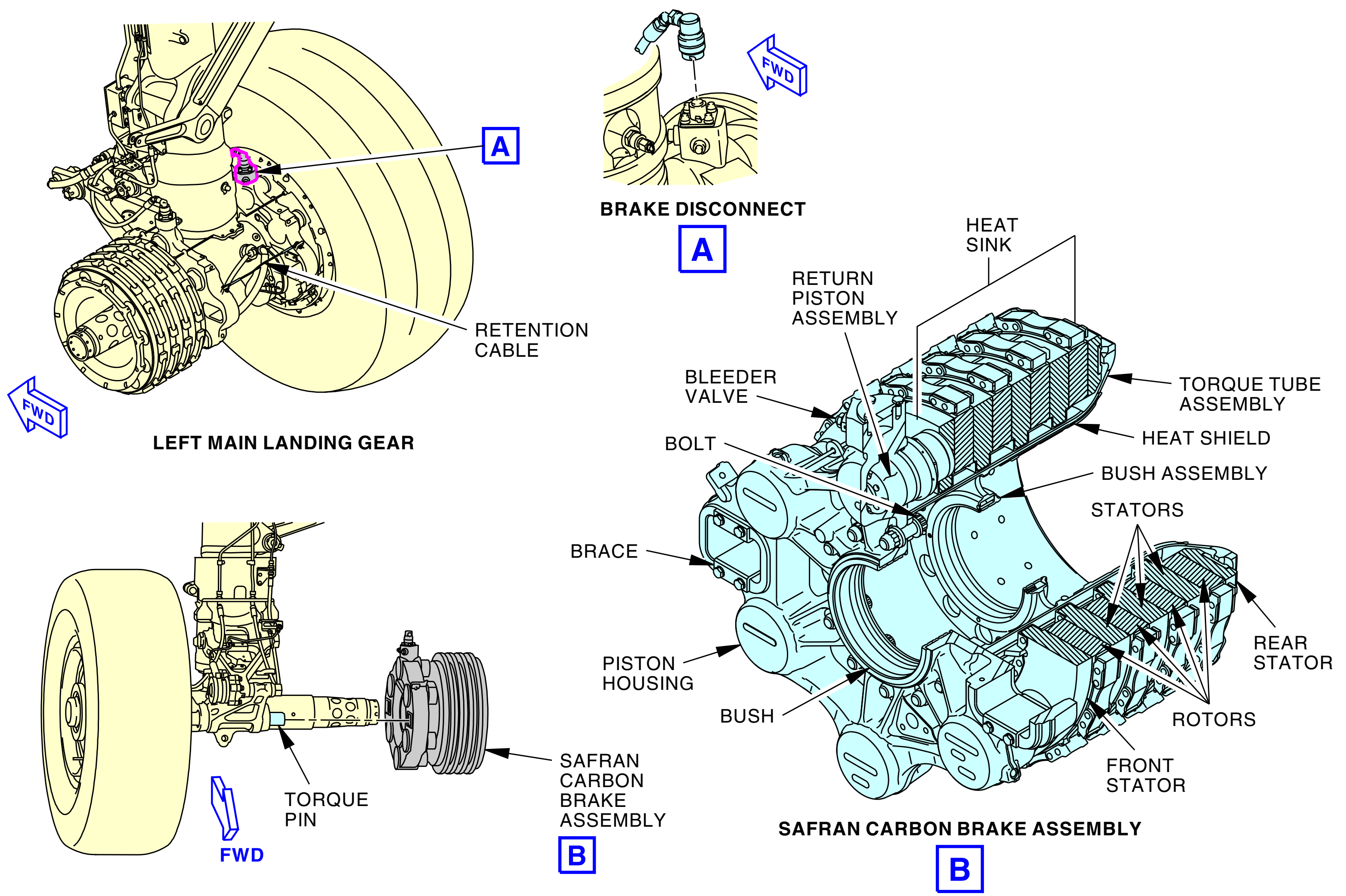
The brake assembly has bushings. These bushings attach to replaceable sleeves on the landing gear axle.

A torque takeout slot on the brake assembly aligns with a torque pin on the bottom of the main landing gear inner cylinder. The slot and pin transmit brake torque to the main landing gear strut.

A retention cable connects both brakes together on each main landing gear. The cable keeps the brake on the axle if the wheel falls off the airplane.

Piston/adjuster assemblies apply brake system hydraulic pressure to the pressure plate. The pressure plate forces the stators and rotors together in the brake housing. This slows or stops the wheel. The pistons automatically adjust for brake wear.

HYDRAULIC BRAKE SYSTEM - BRAKE ASSEMBLY



HYDRAULIC BRAKE SYSTEM - CARBON BRAKE ASSEMBLY

HYDRAULIC BRAKE SYSTEM - FUNCTIONAL DESCRIPTION

General

The source selection operation supplies pressure for these different brake modes:

- Normal brakes
- Alternate brakes
- Accumulator brakes
- Gear retract braking.

When the pressure in one hydraulic brake source decreases, the alternate brake selector valve changes position to set the next available source. This pressure goes to the normal or alternate brake metering valves. The accumulator isolation valve closes to hold pressure in the brake accumulator during alternate brake operation. The accumulator isolation valve opens to send accumulator pressure to the normal brake metering valves when hydraulic system A and B do not supply pressure.

Brake pedal input goes through the brake pedal bus mechanism and cables to the left and right brake metering valves. The metering valves use this mechanical input to control the pressure source and pressurize the brakes.

Normal Brakes

When hydraulic system B supplies pressure, the alternate brake selector valve moves to stop pressure to the alternate brake system. The brakes then get metered hydraulic system B pressure from the normal brake metering valves.

Hydraulic system B pressure also charges the brake accumulator and moves the accumulator isolation valve.

Alternate Brakes

When hydraulic system B pressure does not supply pressure, hydraulic system A pressure moves the alternate brake selector valve. The alternate brake selector valve sends hydraulic system A pressure to the alternate brake system. The brakes can then get metered hydraulic system A pressure from the alternate brake metering valves.

Pressure in the alternate brake system moves the accumulator isolation valve to isolate accumulator pressure.

Accumulator Brakes

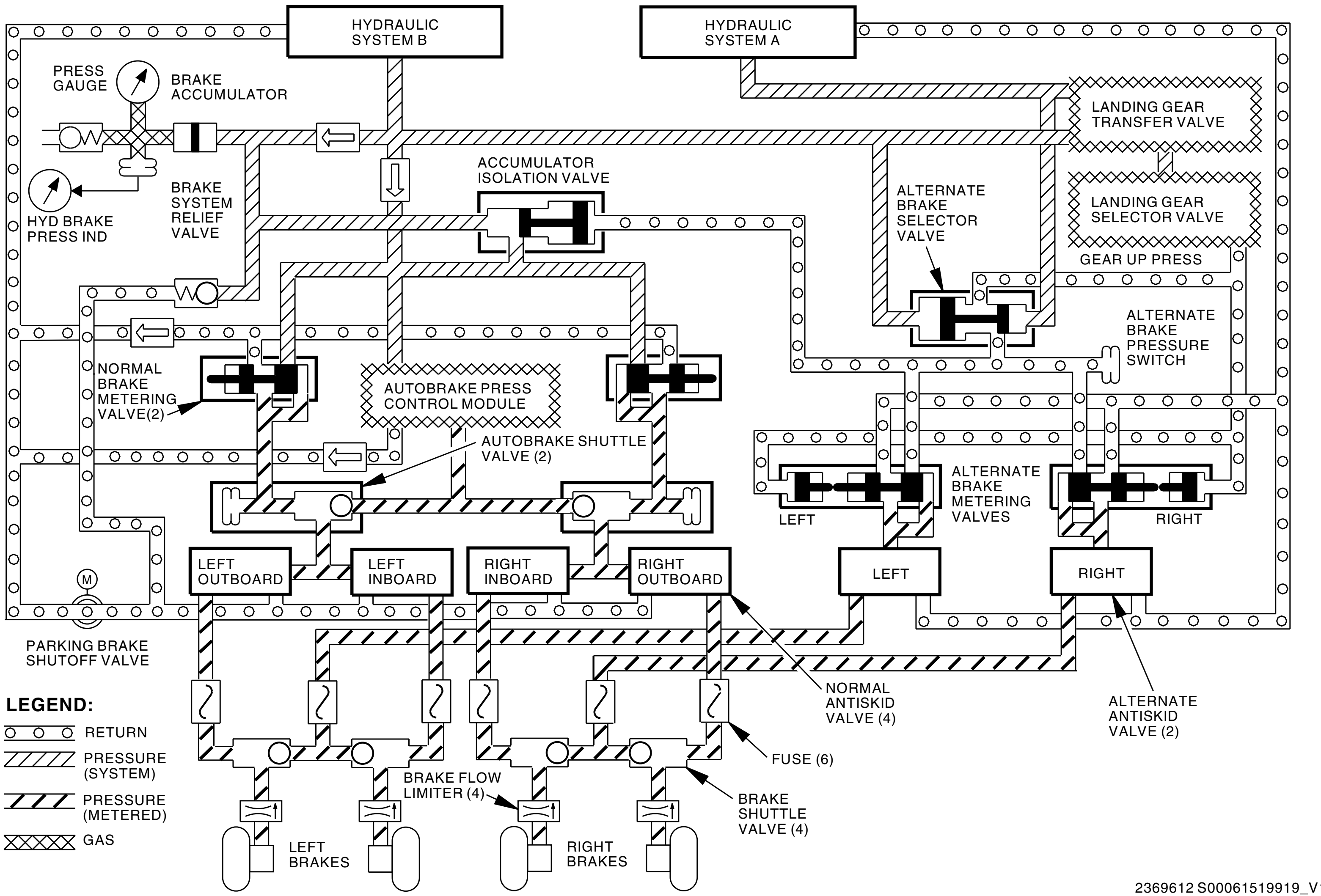
When neither hydraulic system A nor B supplies pressure, accumulator pressure moves the accumulator isolation valve. The brakes then get brake accumulator pressure from the normal brake metering valves.

The brake system relief valve starts to open at 3500 psi to protect the accumulator when the accumulator pressure increases to more than normal.

Gear Retract Braking

When the normal brake system receives pressure during landing gear retraction, the alternate brake selector valve sends landing gear retract pressure to the alternate brake system. The gear retract pressure operates the alternate brake metering valves to the brakes applied position. This stops wheel spin before they go into the wheel well.

HYDRAULIC BRAKE SYSTEM - FUNCTIONAL DESCRIPTION



HYDRAULIC BRAKE SYSTEM - FUNCTIONAL DESCRIPTION

HYDRAULIC BRAKE SYSTEM - BRAKE PRESSURE TRANSDUCER

Purpose

The brake pressure transducer monitors metered brake pressure of the normal and alternate brake systems and sends electrical signals to the flight data acquisition unit (FDAU).

Location

The brake pressure transducers for the normal brake system are on the aft bulkhead of the main landing gear wheel well, down stream of the autobrake shuttle valves before the antiskid valves. One for the left brake system and one for the right brake system.

The brake pressure transducers for the alternate brake system are on the outboard sides of the upper bulkhead of the main landing gear wheel well, down stream of the alternate brake metering valves before the antiskid valves. One for the left brake system and one for the right brake system.

Physical Description

Each brake pressure transducer is a sealed assembly with a piston, disc spring, and electrical switch.

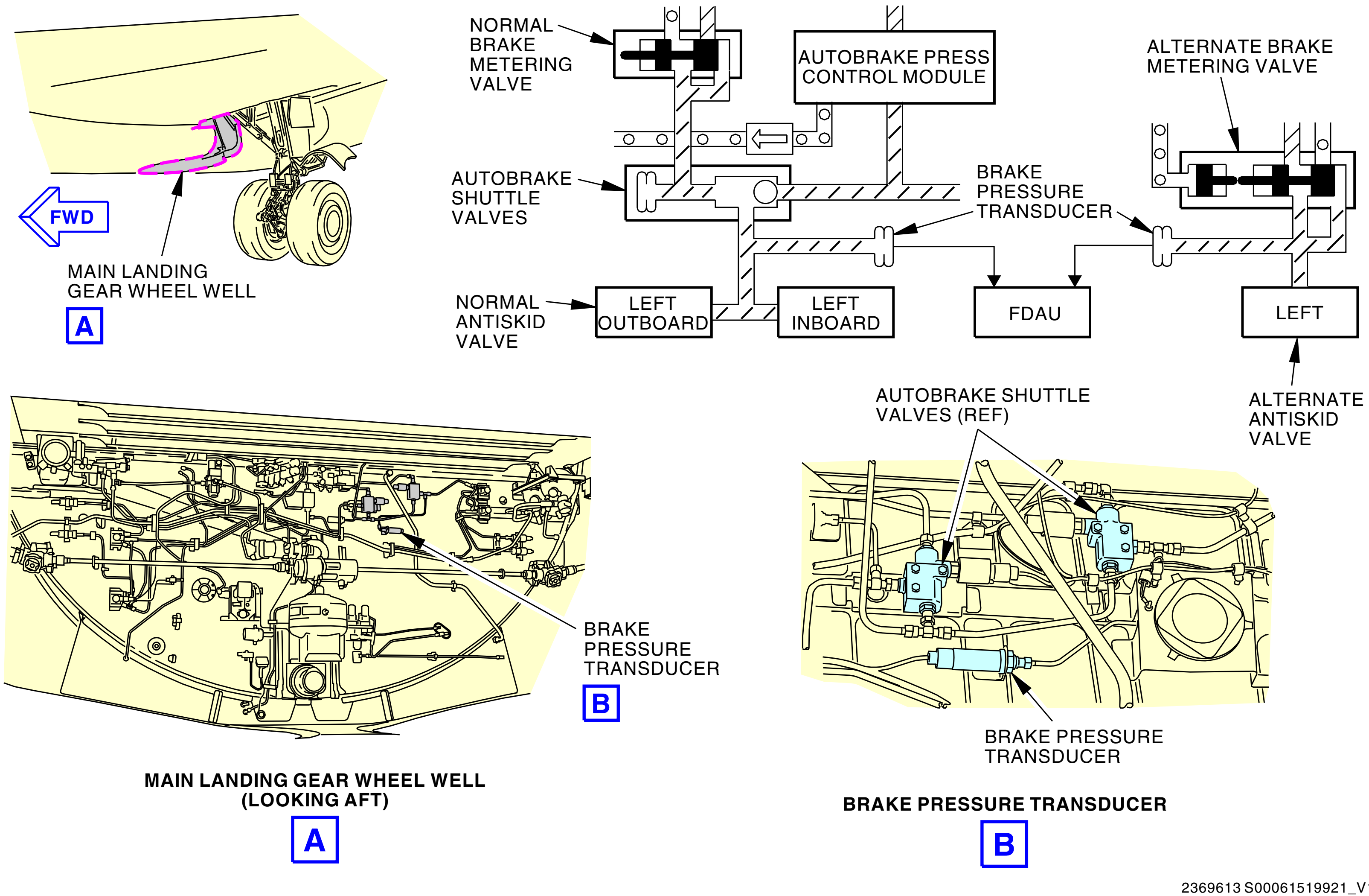
The brake pressure transducers are interchangeable.

Functional Description

The normal brake pressure transducers monitor left and right metered brake pressure from the normal brake metering valves or the autobrake pressure control module. Each transducer sends electrical signals to the FDAU.

The alternate brake pressure transducers monitor left and right metered brake pressure from the alternate brake metering valves. Each transducer sends electrical signals to the FDAU.

HYDRAULIC BRAKE SYSTEM - BRAKE PRESSURE TRANSDUCER



HYDRAULIC BRAKE SYSTEM - BRAKE PRESSURE TRANSDUCER

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ANTISKID/AUTOBRAKE SYSTEM - INTRODUCTION

Purpose

The antiskid system controls the brake system to prevent wheel skids during brake application.

The autobrake system supplies metered brake pressure to stop the airplane after the airplane lands or if a rejected takeoff (RTO) occurs.

Antiskid System

The antiskid system monitors wheel deceleration and controls the brake metered pressure to prevent skid conditions. These are the antiskid functions:

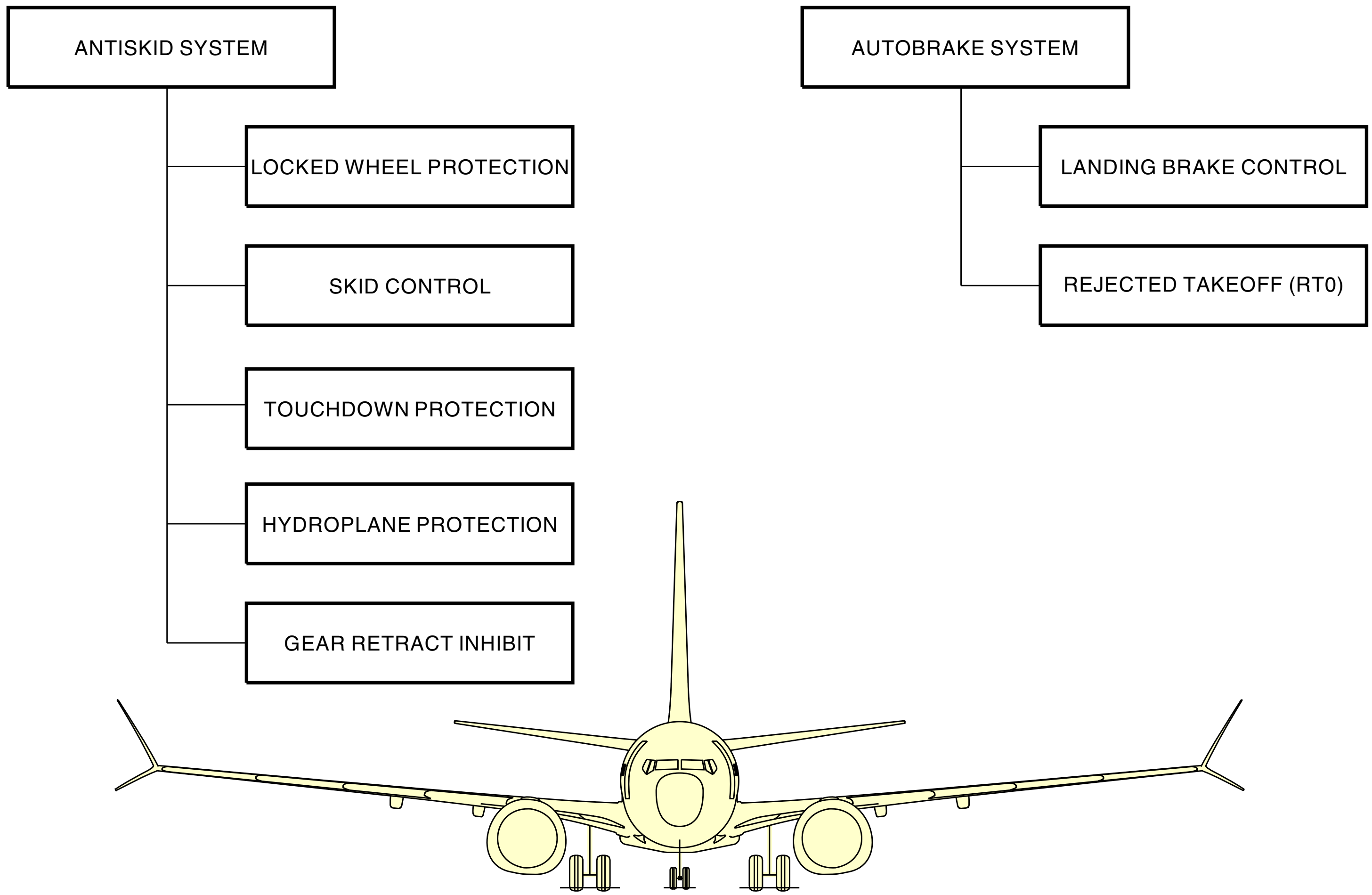
- Skid control operates at more than eight knots to control each wheel deceleration during normal antiskid and both wheels on each main landing gear during alternate antiskid
- Locked wheel protection compares wheel speeds more than 25 knots of the two inboard or the two outboard wheels and releases brake pressure from the slower wheel
- Touchdown protection prevents wheel brake operation of 2 and 4 when the airplane is in the air
- Hydroplane protection decreases wheel brake pressure to 1 and 3 when ground speed is more than wheel speed
- Gear retract inhibit prevents the alternate anitskid system from operation during normal landing gear retraction.

Autobrake System

The autobrake system monitors wheel deceleration and controls metered pressure on touchdown to maintain what the pilot selected on the AUTO BRAKE select switch until the airplane comes to a full stop. These are the autobrake functions:

- 1, 2, 3, and MAX deceleration positions command the autobrake system during landing brake control to modulate brake pressure until the airplane is at a full stop
- The rejected takeoff (RTO) position commands the autobrake system to apply full pressure to the wheel brakes and stop the airplane. The autobrake system operates in RTO when the pilot starts a rejected takeoff at groundspeed more than 88 knots.

ANTISKID/AUTOBRAKE SYSTEM - INTRODUCTION



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ANTISKID/AUTOBRAKE SYSTEM - INTRODUCTION

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ANTISKID/AUTOBRAKE SYSTEM - ANTISKID GENERAL DESCRIPTION

Purpose

The antiskid system controls the metered brake pressure from the hydraulic brake system or the autobrake pressure from the autobrake system to prevent wheel skid. This gives maximum brake force to stop the airplane with any runway condition.

Components

These are the antiskid components:

SIA 001 PRE SB 737-32-1527

- Antiskid valves (6)

SIA 002-999; SIA 001 POST SB 737-32-1527

- Antiskid valves (4)

SIA ALL

- Transducers (4)
- Landing gear lever up switch
- Alternate brake pressure switch
- Antiskid/autobrake control unit (AACU)
- Antiskid inoperative amber light.

Antiskid Valves

SIA 001 PRE SB 737-32-1527

Four antiskid valves in the normal hydraulic brake system control brake pressure to each wheel brake. Two antiskid valves in the alternate hydraulic brake system control brake pressure to the wheel brakes on each main landing gear.

SIA 002-999; SIA 001 POST SB 737-32-1527

Two antiskid valves in the normal hydraulic brake system control brake pressure to each wheel brake. Two antiskid valves in the alternate hydraulic brake system control brake pressure to the wheel brakes on each main landing gear.

SIA ALL

Transducer

A transducer in each main landing gear wheel axle supplies wheel speed data to the AACU.

Landing Gear Lever Up Switches

The landing gear lever up switches sends the position of the landing gear lever to the AACU.

Alternate Brake Pressure Switch

The alternate brake pressure switch shows that the alternate hydraulic brake system has pressure.

Antiskid/Autobrake Control Unit

The AACU controls antiskid operation and monitors the system for faults.

Antiskid Inoperative Amber Light

The ANTISKID INOP amber light comes on if there is a fault in the antiskid system.

General Description

The AACU gets wheel speed data from the transducers. The left and right ADIRUs supply ground speed data. The PSEU supplies air/ground signals from system 1 and system 2 to the AACU for touchdown/hydroplane protection. The parking brake system supplies a signal when there is a disagreement between the parking brake valve and the parking brake switch.

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID GENERAL DESCRIPTION

When a wheel skids, the AACU sends signals to the antiskid valves. If the normal brake system has pressure, the antiskid valve in the normal hydraulic brake system releases pressure for that wheel. This permits wheel speed to increase and stop the skid condition.

The normal antiskid valve releases unwanted brake pressure through the parking brake valve. The antiskid system monitors the correct operation of the parking brake valve to make sure the unwanted brake pressure can be released.

If the alternate hydraulic brake system has pressure, the antiskid system operates almost the same as the normal system. If a wheel on one main landing gear skids, the antiskid valve in the alternate hydraulic brake system releases the brake pressure to the two brakes on that main landing gear.

When the alternate brake pressure switch has pressure, it sends signals to the alternate antiskid sense relay and the flight data acquisition unit (FDAU).

The AACU sends signals to the auto speedbrake module when each wheel speed is more than 60 knots. The auto speedbrake module uses the wheel speed input to operate the auto speedbrake actuator during the RTO function.

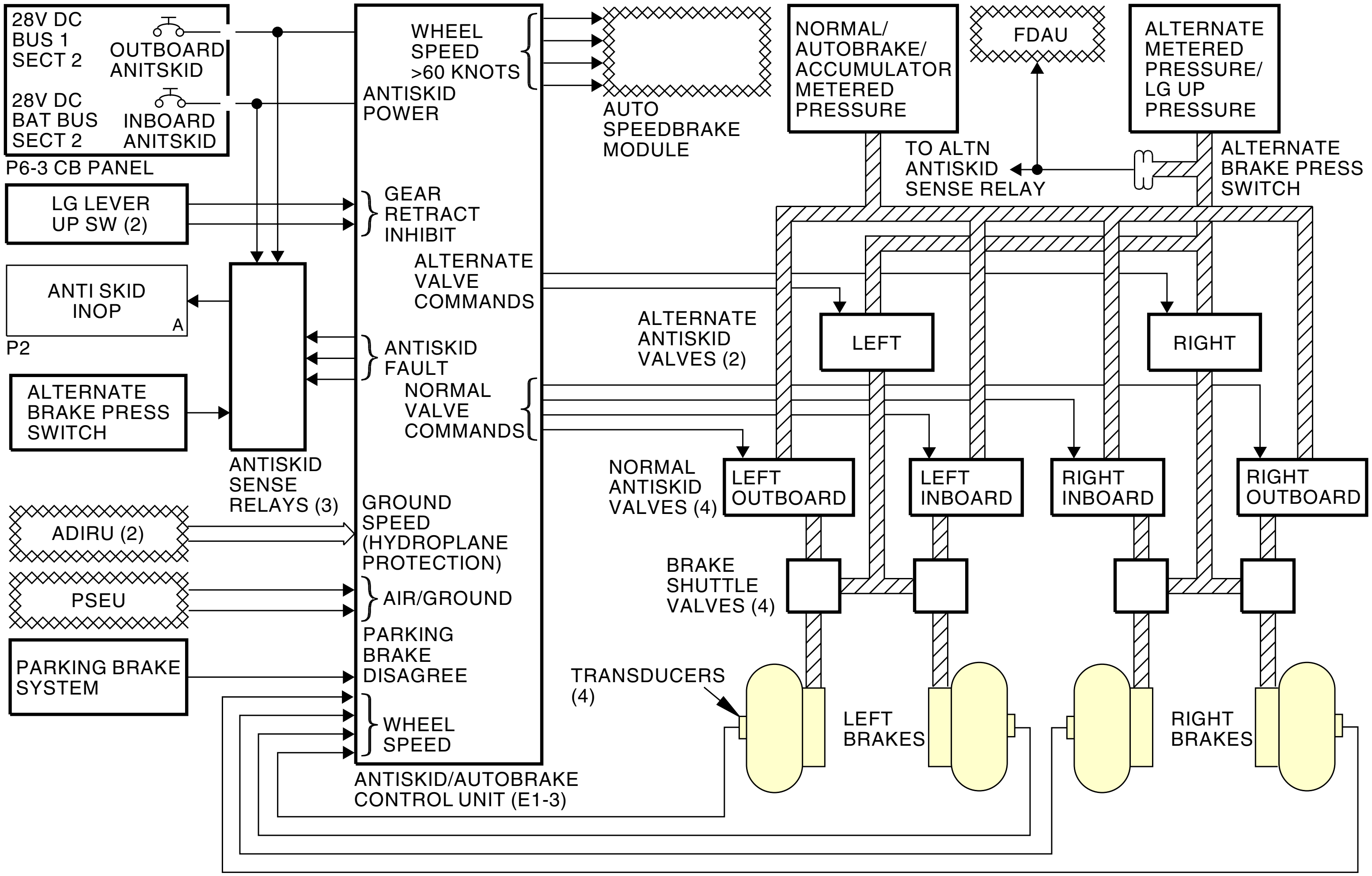
See the air/ground system section for more information about the PSEU. (SECTION 32-09)

See the parking brake system section for more information about the parking brake system. (SECTION 32-44)

See the flight data recording system (FDRS) section for more information about the FDAU. (SECTION 31-31)

See the speedbrake control system section for more information about the auto speedbrake system. (SECTION 27-62)

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID GENERAL DESCRIPTION



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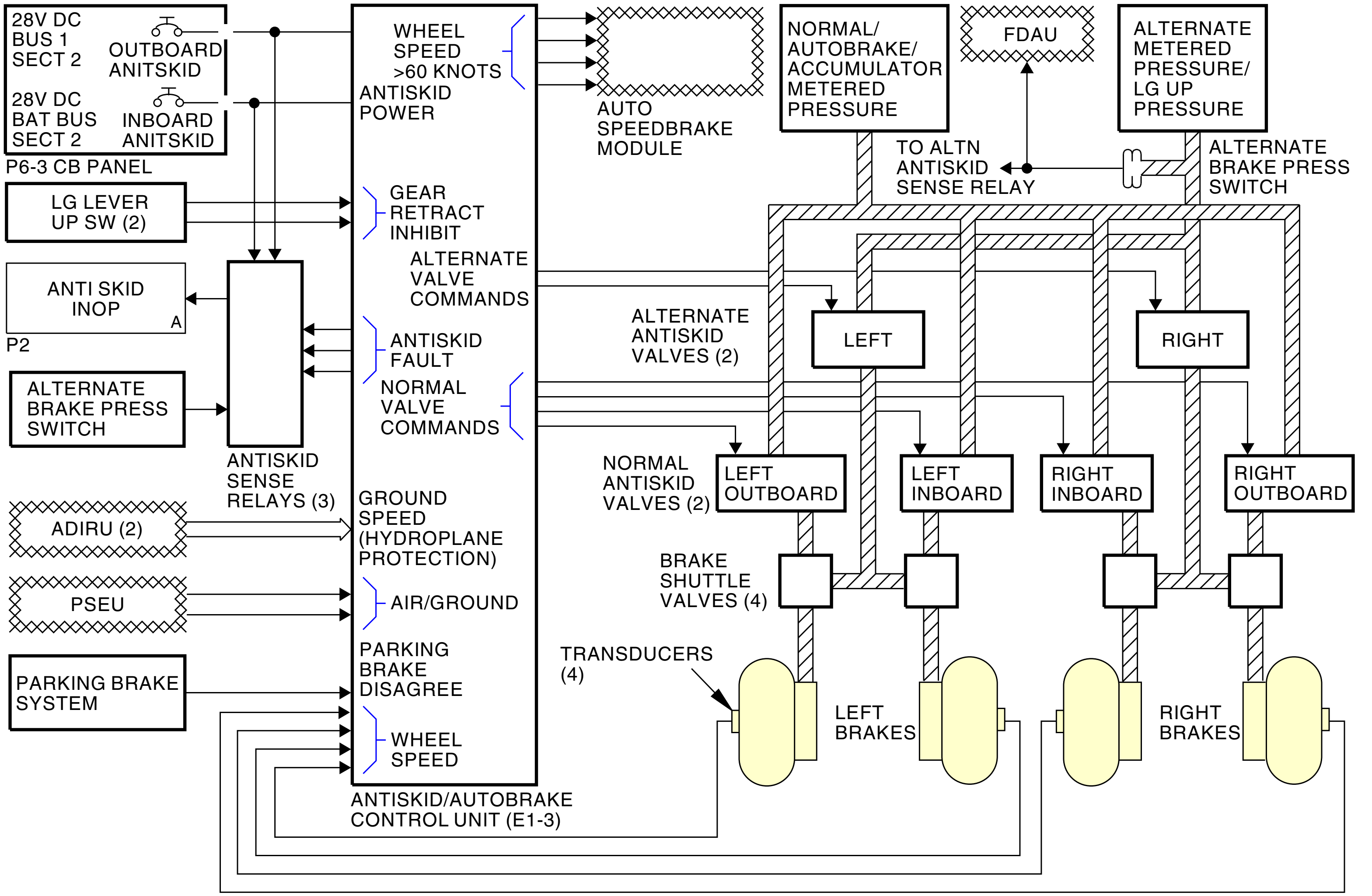
ANTISKID/AUTOBRAKE SYSTEM - ANTISKID GENERAL DESCRIPTION

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID GENERAL DESCRIPTION



ANTISKID/AUTOBRAKE SYSTEM - ANTISKID GENERAL DESCRIPTION

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE GENERAL DESCRIPTION

General

The autobrake system applies the brakes to stop the airplane after it lands or during a rejected takeoff.

These are the autobrake components of the antiskid/autobrake system:

- Antiskid/autobrake control unit (AACU)
- AUTO BRAKE select switch
- Autobrake pressure control module
- Autobrake shuttle valves (2)
- AUTO BRAKE DISARM amber light.

The autobrake system does not operate with the alternate hydraulic brake system.

Antiskid/Autobrake Control Unit

The antiskid/autobrake control unit controls autobrake operation. The antiskid/autobrake control unit gets inputs from these sources:

- Speed brake arming switch
- Autothrottle switch packs (2)
- ADIRU (2)
- PSEU
- Autobrake pressure control module
- Autobrake shuttle valve (2)
- Transducers (4).

AUTO BRAKE Select Switch

The AUTO BRAKE select switch lets the pilot select a rate of deceleration to the antiskid/autobrake control unit for landing autobrake or rejected takeoff (RTO) braking operation.

Autobrake Pressure Control Module

The autobrake pressure control module sends autobrake pressure through the autobrake shuttle valves to the normal brake system. Hydraulic system B supplies pressure to the autobrake pressure control module.

Autobrake Shuttle Valve

The autobrake shuttle valve sends autobrake pressure to the normal brake system. It does this when normal metered pressure is less than autobrake pressure. The metered pressure switch on the autobrake shuttle valve sends signals to the antiskid/autobrake control unit when the normal brake metering valves supply pressure.

AUTO BRAKE DISARM Amber Light

The AUTO BRAKE DISARM amber light comes on when the pilot selects autobrakes and any of these conditions occur:

- Malfunction in the autobrake system
- Malfunction in the antiskid system
- Autobrake system is manually disarmed.

General Description

You select an autobrake landing rate of deceleration or RTO braking with the AUTO BRAKE select switch.

When all conditions for arming and application are correct, the AACU controls the autobrake pressure control module. The autobrake pressure control module sends autobrake pressure to the brakes through the normal hydraulic brake system. The autobrake pressure control module also sends brake pressure electrical signals to the flight data acquisition unit for recording purposes.

See the flight data recording system (FDRS) section for more information about the FDAU. (SECTION 31-31)

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE GENERAL DESCRIPTION

The AACU sends signals to the auto speedbrake module when each wheel speed is more than 60 knots. The auto speedbrake module uses the wheel speed input to operate the auto speedbrake actuator during the RTO function.

See the speedbrake control system section for more information about the auto speedbrake system. (SECTION 27-62)

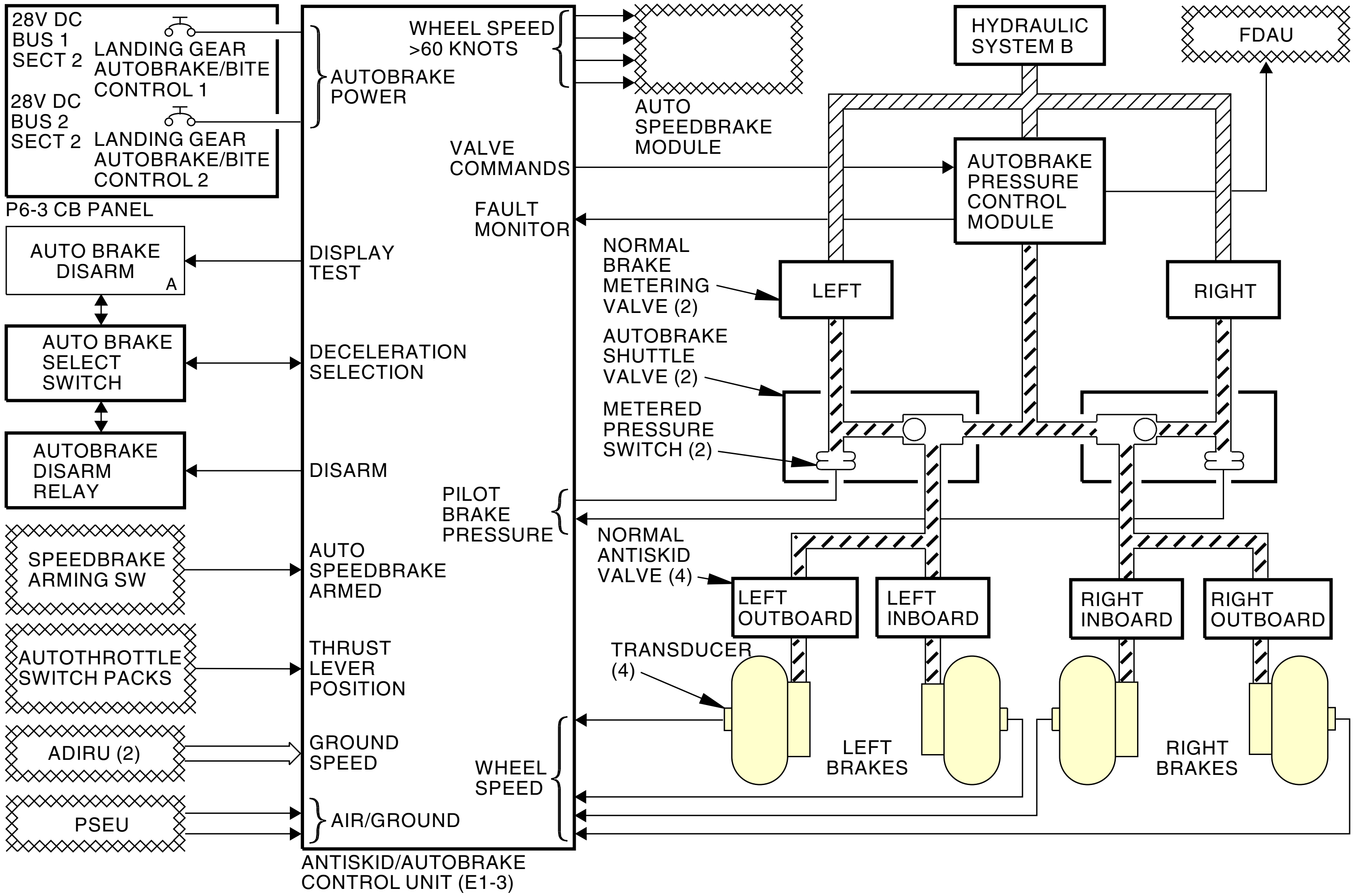
The antiskid system operates normally during autobrake operation.

When all conditions for disarming and de-application are correct, the AACU controls these components:

- Autobrake pressure control module
- Autobrake disarm relay
- AUTO BRAKE DISARM amber light.

Manual brake application by the pilot will override and disarm the autobrake system.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE GENERAL DESCRIPTION



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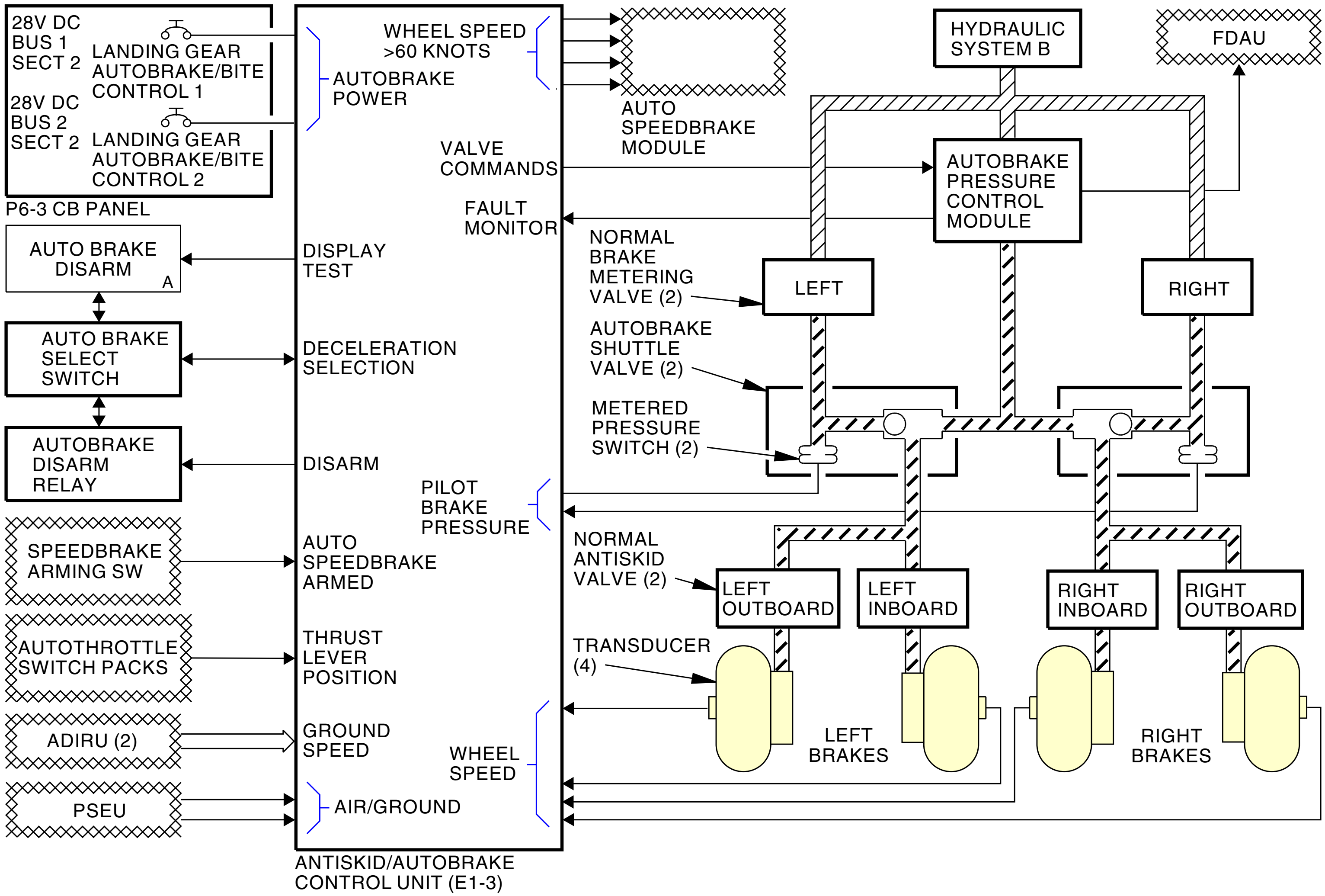
ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE GENERAL DESCRIPTION

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE GENERAL DESCRIPTION



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ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE GENERAL DESCRIPTION

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ANTISKID/AUTOBRAKE SYSTEM - TRANSDUCER

Purpose

The antiskid transducers supply wheel speed data to the antiskid/autobrake control unit to get wheel deceleration data. This data also goes to the antiskid/autobrake control unit for autobrake operation.

Location

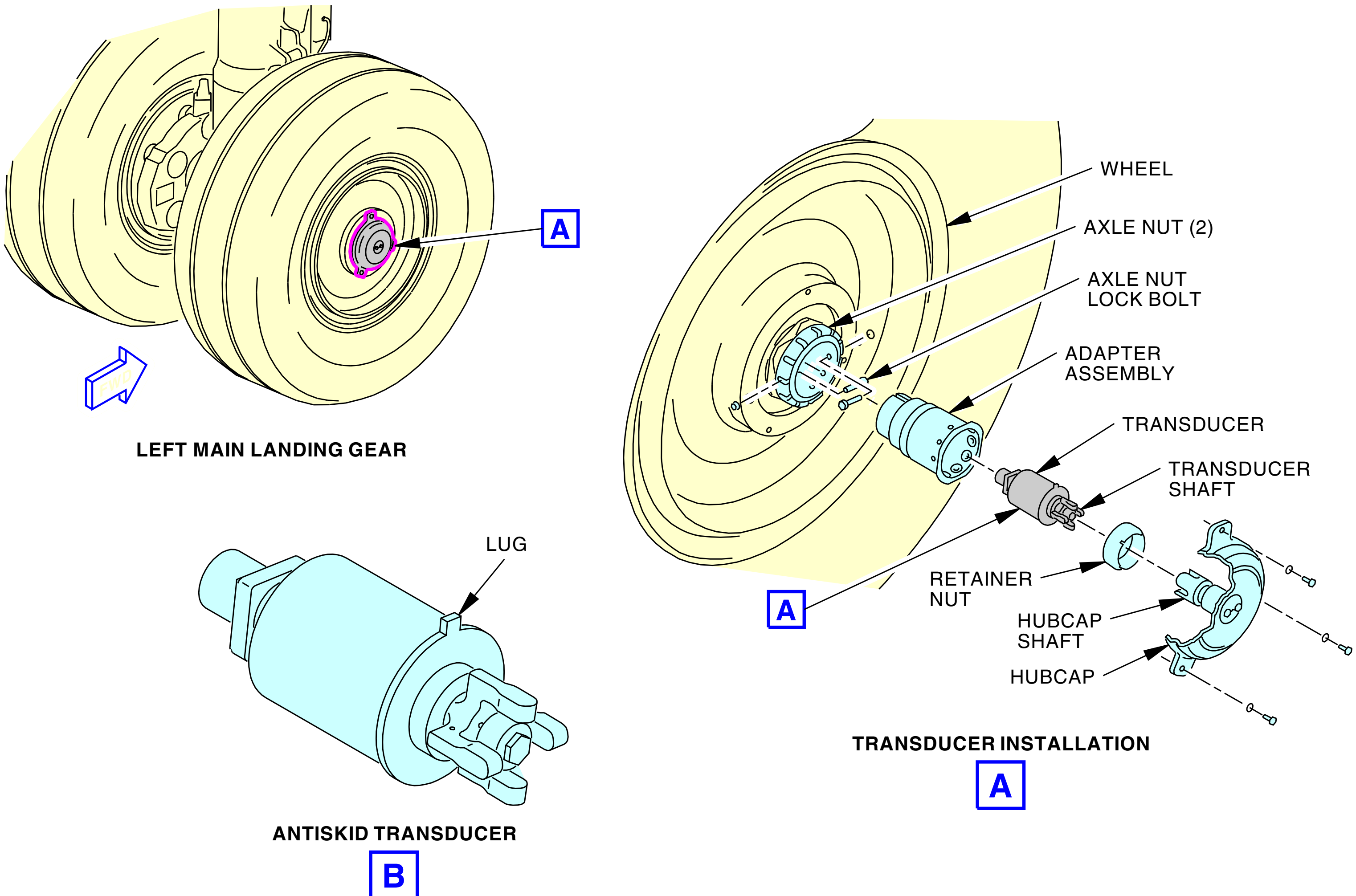
There are four antiskid transducers. Each main landing gear wheel has a transducer in the axle.

Physical Description

When the transducer shaft turns, it provides wheel speed input to the transducer. The hubcap shaft on the inside of the hubcap turns the transducer shaft when the wheel turns.

A lug on the transducer aligns with a slot in the adapter assembly. This prevents rotation of the transducer in the adapter assembly.

ANTISKID/AUTOBRAKE SYSTEM - TRANSDUCER



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ANTISKID/AUTOBRAKE SYSTEM - TRANSDUCER

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID/AUTOBRAKE CONTROL UNIT

Purpose

The antiskid/autobrake control unit (AACU) contains circuit cards for the antiskid and autobrake systems and for the related BITE functions.

Location

The antiskid/autobrake control unit is on the E1-3 shelf in the electronic equipment compartment.

Physical Description

The antiskid/autobrake control unit includes these cards:

- Outboard antiskid card
- Inboard antiskid card
- Autobrake card
- BITE card.

Functional Description

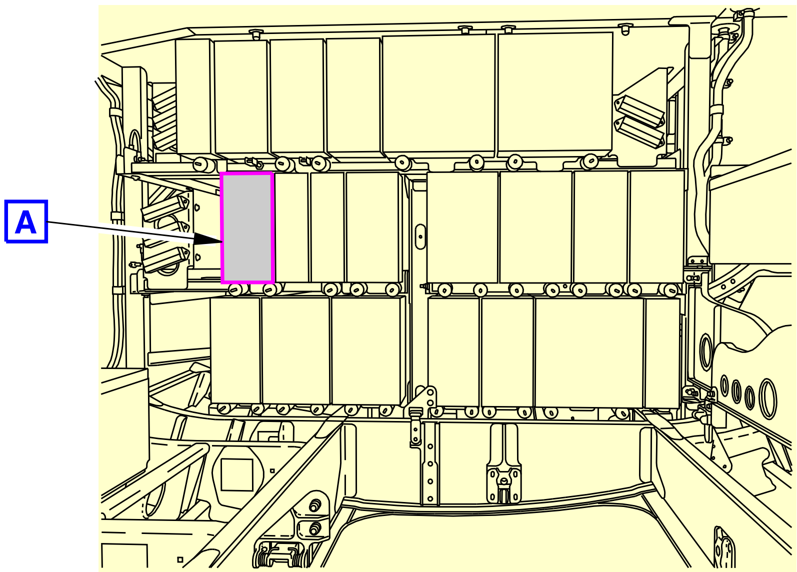
The antiskid/autobrake control unit sends brake release inputs to the antiskid valves and brake application inputs to the autobrake pressure control module.

The antiskid/autobrake control unit also monitors the antiskid and autobrake systems for faults and does the built-in test functions.

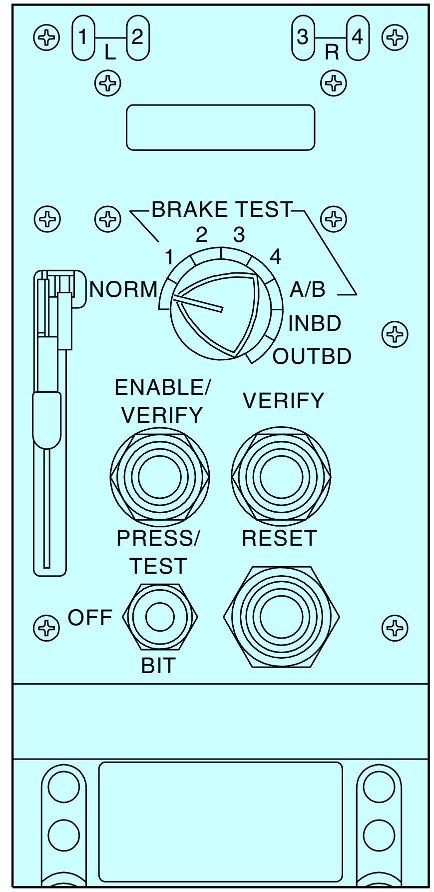
Built-in test functions on the BITE panel of the antiskid/autobrake control unit lets you show faults and do tests on the antiskid and autobrake systems.

CAUTION DO NOT TOUCH THE ANTISKID/AUTOBRAKE CONTROL UNIT BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE ANTISKID/AUTOBRAKE CONTROL UNIT.

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID/AUTOBRAKE CONTROL UNIT



ELECTRONIC EQUIPMENT COMPARTMENT
(VIEW IN THE FORWARD DIRECTION)



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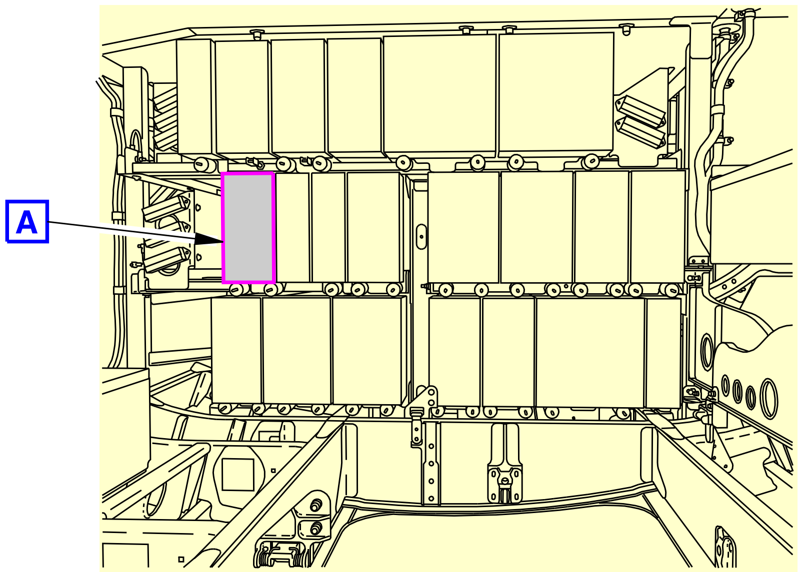
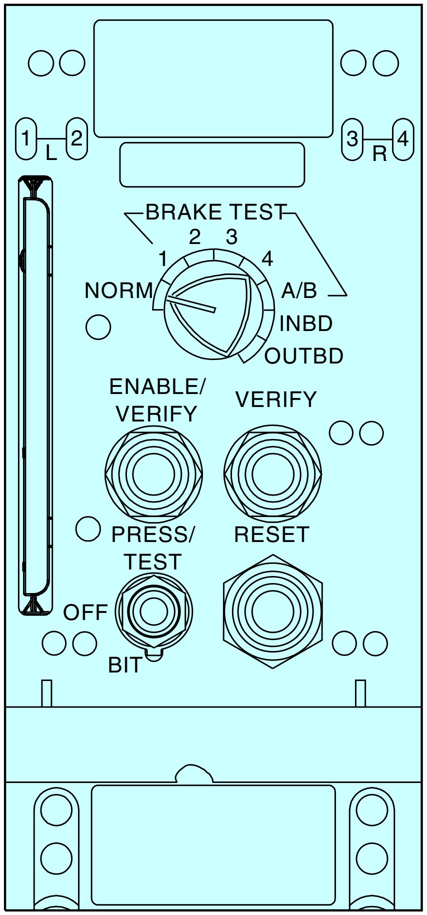
ANTISKID/AUTOBRAKE SYSTEM - ANTISKID/AUTOBRAKE CONTROL UNIT

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID/AUTOBRAKE CONTROL UNIT



ELECTRONIC EQUIPMENT COMPARTMENT
(VIEW IN THE FORWARD DIRECTION)



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ANTISKID/AUTOBRAKE SYSTEM - ANTISKID/AUTOBRAKE CONTROL UNIT

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ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE

Purpose

The antiskid valves release brake pressure to prevent wheel skids.

SIA 001 PRE SB 737-32-1527

Four antiskid valves in the normal hydraulic brake system give protection to each wheel during normal brake operation. Two antiskid valves in the alternate hydraulic brake system each give protection to both wheels on a main landing gear during alternate brake operation.

SIA 002-999; SIA 001 POST SB 737-32-1527

Two antiskid valves in the normal hydraulic brake system give protection to each wheel during brake operation. Two antiskid valves in the alternate hydraulic brake system each give protection to both wheels on a main landing gear during alternate brake operation.

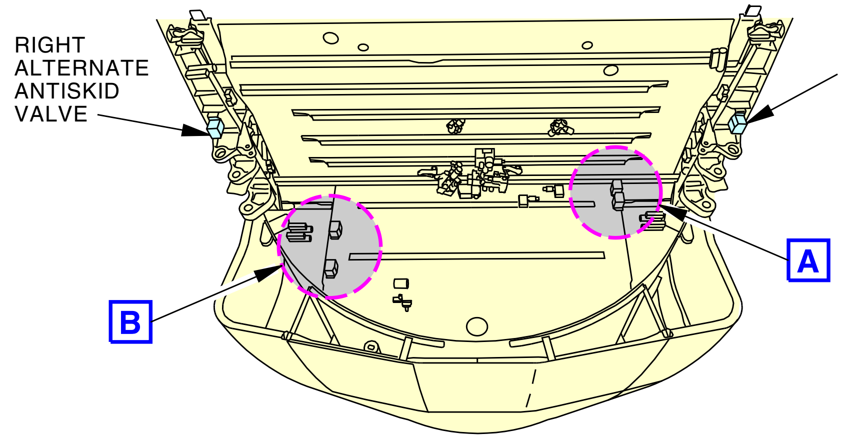
SIA ALL

Location

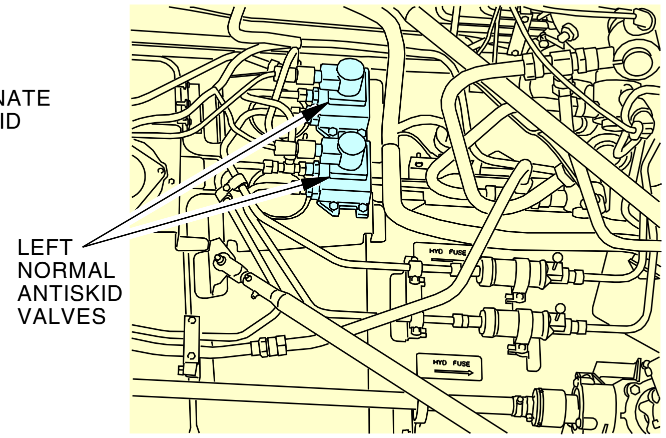
The antiskid valves for the normal brake system are on the aft bulkhead of the main landing gear wheel well.

The antiskid valves for the alternate brake system are on the outboard sides of the ceiling of the main landing gear wheel well.

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE



MAIN LANDING GEAR WHEEL WELL
(LOOKING AFT)



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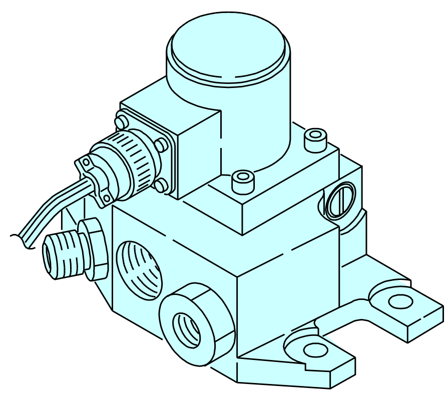
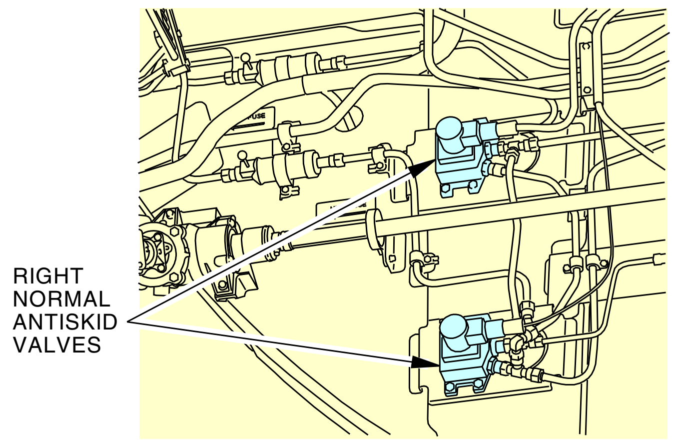


ANTISKID VALVE



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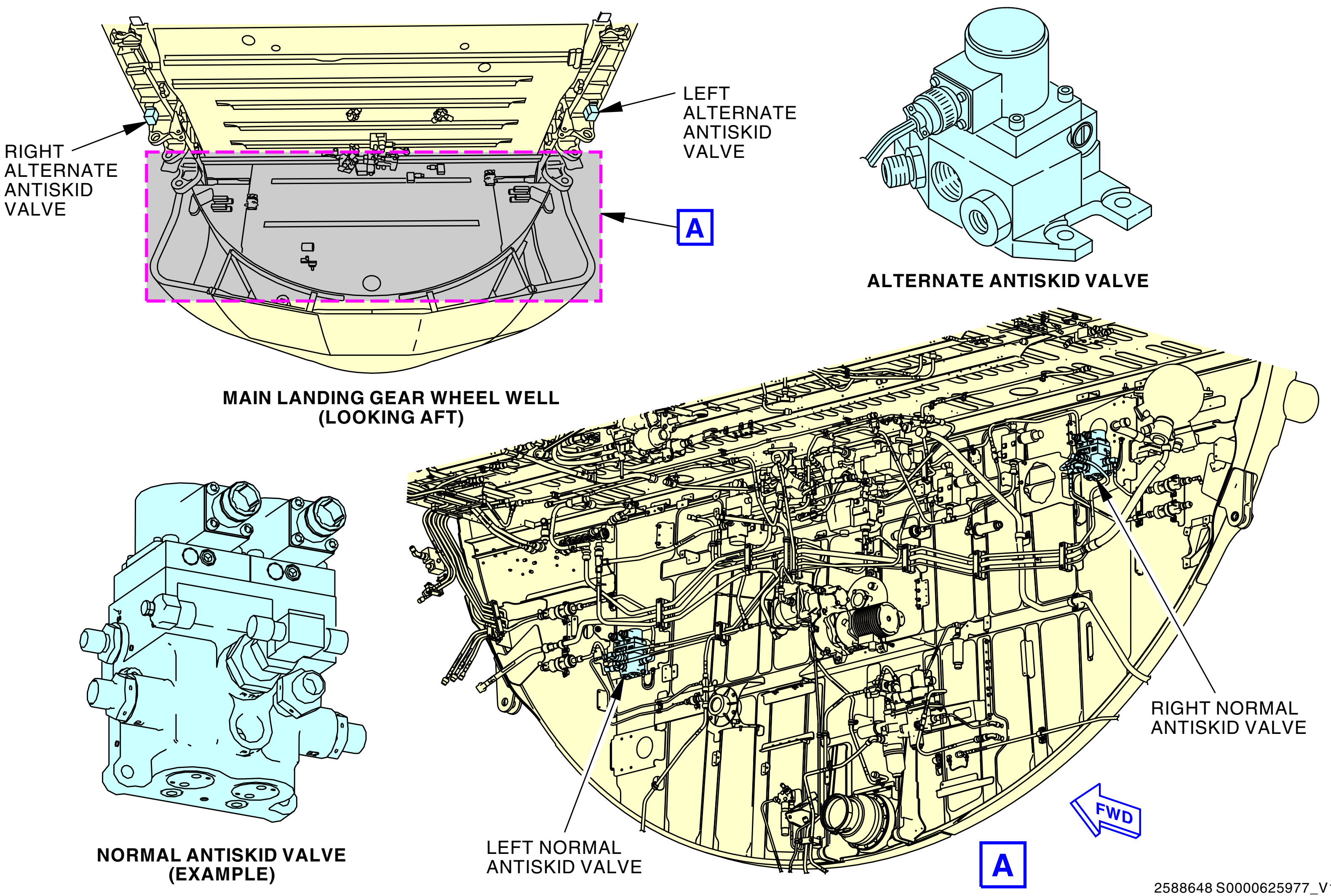
ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE



ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE

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ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE - FUNCTIONAL DESCRIPTION

General

SIA 001 PRE SB 737-32-1527

Four antiskid valves in the normal hydraulic brake system control the brake pressure for each brake independently. Two antiskid valves in the alternate hydraulic brake system each control brake pressure for both brakes on one of the main landing gear. All six antiskid valves are the same.

SIA 002-999; SIA 001 POST SB 737-32-1527

Two antiskid valves in the normal hydraulic brake system control the brake pressure for each brake independently. Two antiskid valves in the alternate hydraulic brake system each control brake pressure for both brakes on one of the main landing gear.

SIA ALL

The antiskid valves have these two stages of control:

- The first stage valve controls pressure in proportion to input current from the antiskid/autobrake control unit.
- The second stage keeps pressure to the brakes equal to the first stage control pressure.

Filters

SIA 001 PRE SB 737-32-1527

In-line screen filters remove contamination from the metered pressure as it goes into the antiskid valve and as it goes out of the valve and to the brake.

SIA 002-999; SIA 001 POST SB 737-32-1527

In-line screen filters remove contamination from the metered pressure as it goes into the antiskid valve.

SIA ALL

First Stage Valve

The first stage valve uses a current controlled flapper between two nozzles to adjust the first stage pressure. One nozzle connects to the metered pressure and the other connects to the return.

When no current goes to the valve, the flapper moves against the return nozzle. In this position, control pressure is the same as metered pressure.

When full current goes to the valve, the flapper moves against the pressure nozzle. In this position, control pressure is the same as return pressure.

For each intermediate value of input current, the flapper moves between the two nozzles to adjust the control pressure.

Second Stage Valve

The second stage valve uses a spool valve. It moves with first stage control pressure and a spring on one end and brake pressure on the other end.

When there is no brake pressure, the spring holds the spool in position to send metered pressure to fill the brakes.

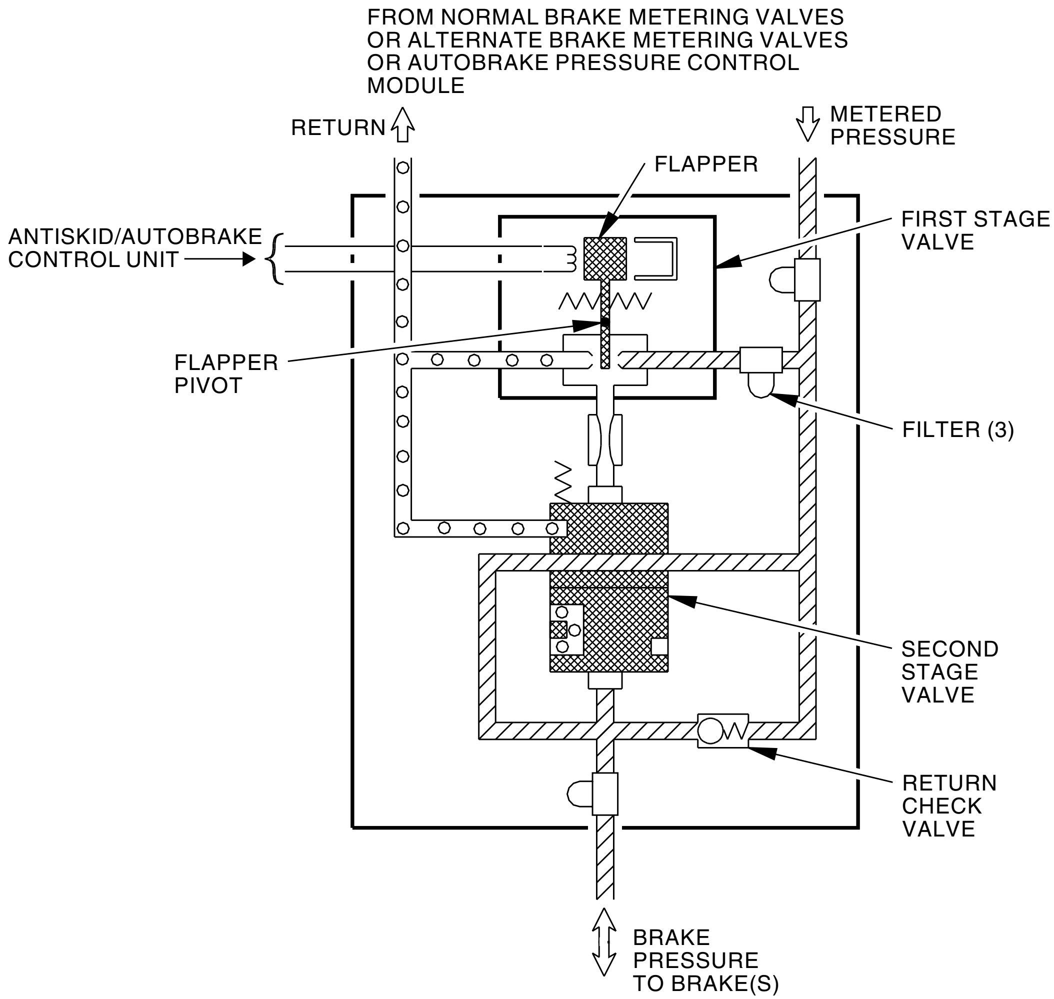
When control pressure is more than brake pressure, the spool moves to send metered pressure to the brakes.

During antiskid operation, the spool operates to keep the brake pressure equal to first stage control pressure. It sends unwanted brake pressure to the system return.

Return Check Valve

If the return line has a blockage and return pressure is more than brake pressure, the return check valve releases brake pressure to metered pressure.

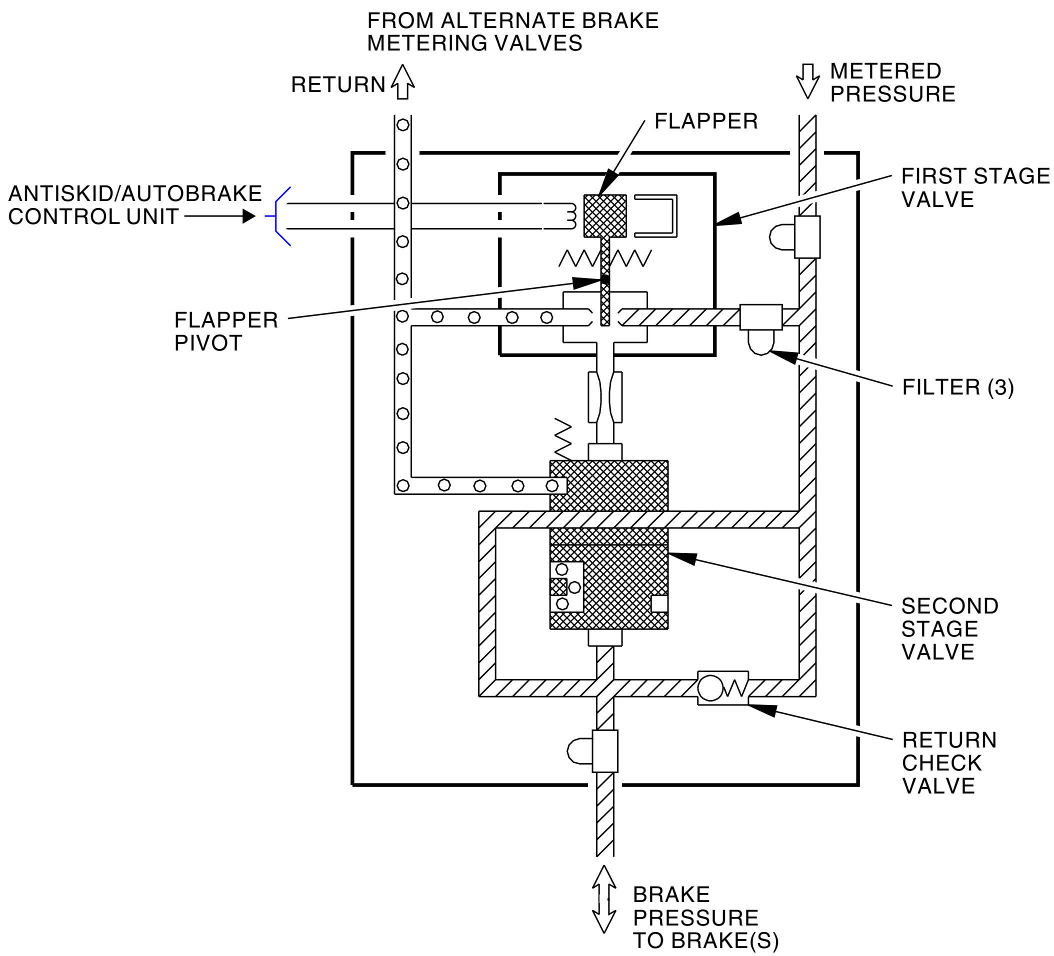
ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE - FUNCTIONAL DESCRIPTION



2369620 S00061519937_V1

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE - FUNCTIONAL DESCRIPTION

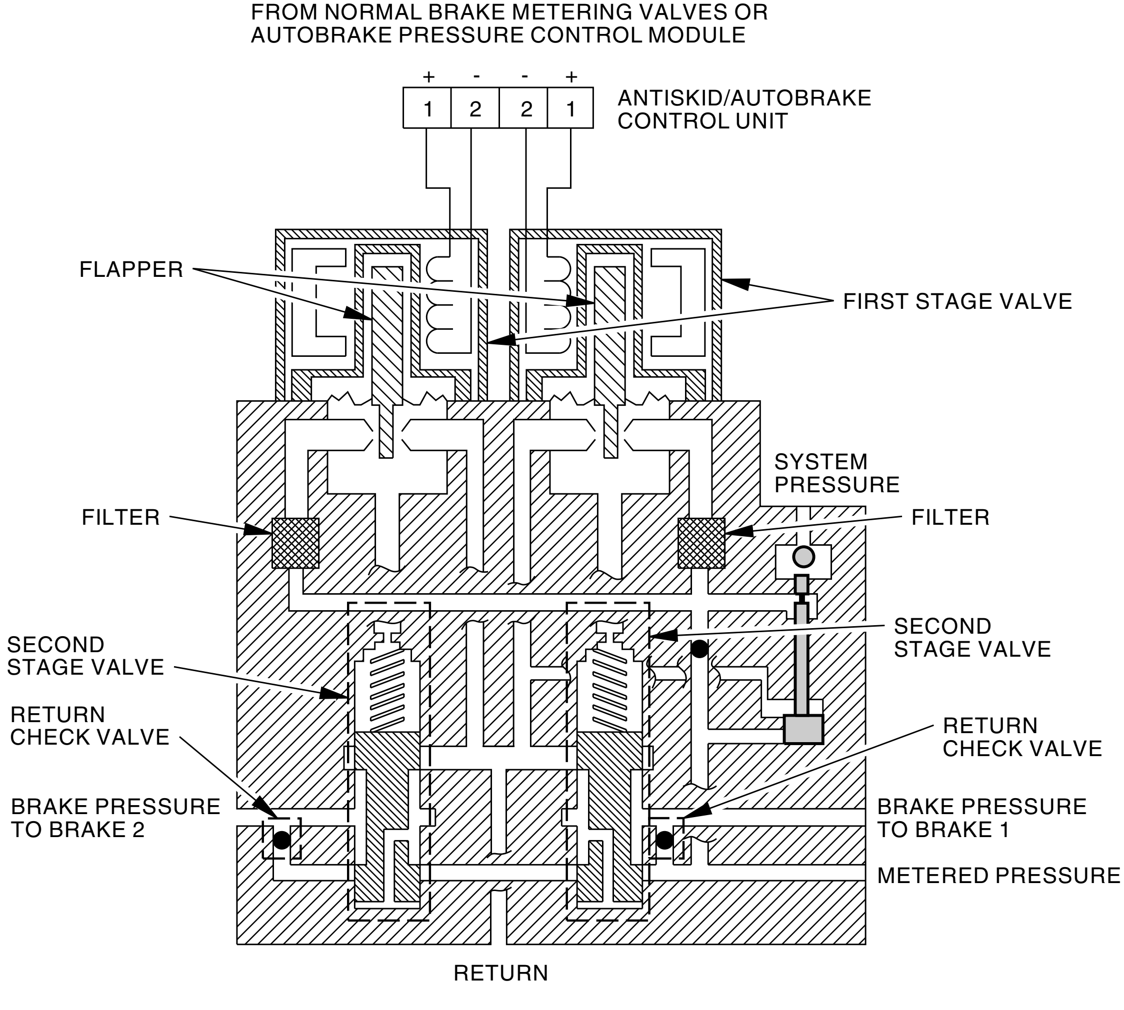
ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE - FUNCTIONAL DESCRIPTION



2588656 S0000625979_V1

ANTISKID/AUTOBRAKE SYSTEM - ALTERNATE ANTISKID VALVE - FUNCTIONAL DESCRIPTION

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID VALVE - FUNCTIONAL DESCRIPTION



ANTISKID/AUTOBRAKE SYSTEM - NORMAL ANTISKID VALVE - FUNCTIONAL DESCRIPTION

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE PRESSURE CONTROL MODULE

Purpose

The autobrake pressure control module uses input from the antiskid/autobrake control unit to meter hydraulic system B pressure to the normal brake system during autobrake operation.

Location

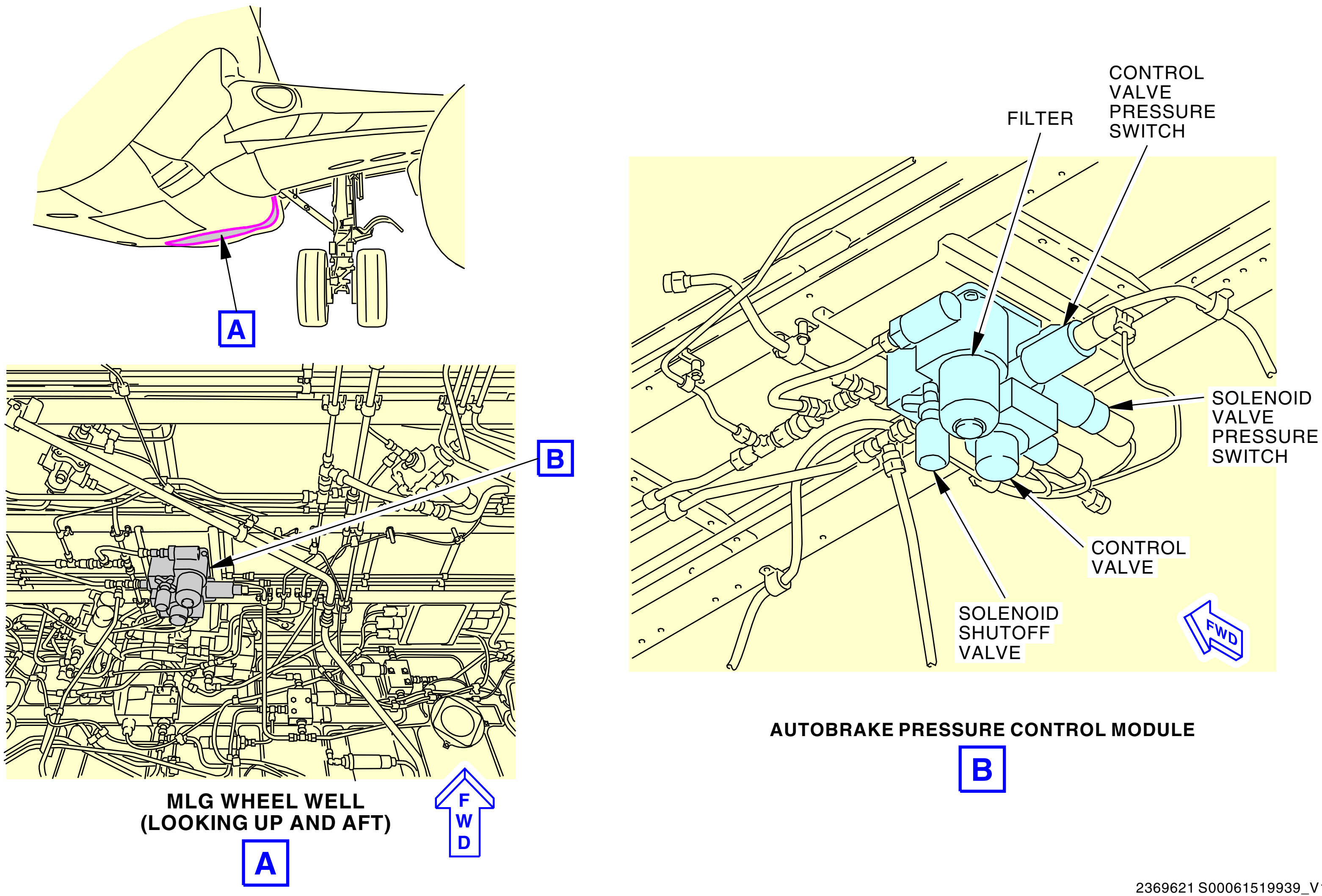
The autobrake pressure control module is on the ceiling of the main landing gear wheel well.

Physical Description

The autobrake pressure control module is an LRU and contains these LRUs:

- Filter
- Control valve pressure switch
- Solenoid valve pressure switch
- Control valve
- Solenoid valve.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE PRESSURE CONTROL MODULE



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ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE PRESSURE CONTROL MODULE

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE PRESSURE CONTROL MODULE - FUNCTIONAL DESCRIPTION

General

The autobrake pressure control module has these components:

- Solenoid valve
- Solenoid valve pressure switch
- Control valve
- Control valve pressure switch.

Solenoid Valve

The solenoid valve is a two-stage valve. The first stage is a solenoid-operated valve. It controls pressure to the second stage valve. The second stage is a pressure-operated valve. It controls pressure to the control valve. The antiskid/autobrake control unit (AACU) sends signals to the solenoid valve.

The AACU uses a solenoid valve pressure switch to monitor the pressure from the solenoid valve for faults. The solenoid valve pressure switch also sends brake pressure signals less than 1000 psi to the flight data aquisition unit for recording purposes.

See the flight data recording system (FDRS) section for more information about the FDAU. (SECTION 31-31)

Control Valve

The control valve is also a two stage valve. The first stage is a variable electro-hydraulic control valve. It sends control pressure to operate the second stage valve. The second stage valve is a metering valve that is almost the same as the brake metering valves. The second stage valve sends autobrake pressure to the normal brake system in proportion to the signal from the AACU. The signal from the AACU operates the first stage of the control valve.

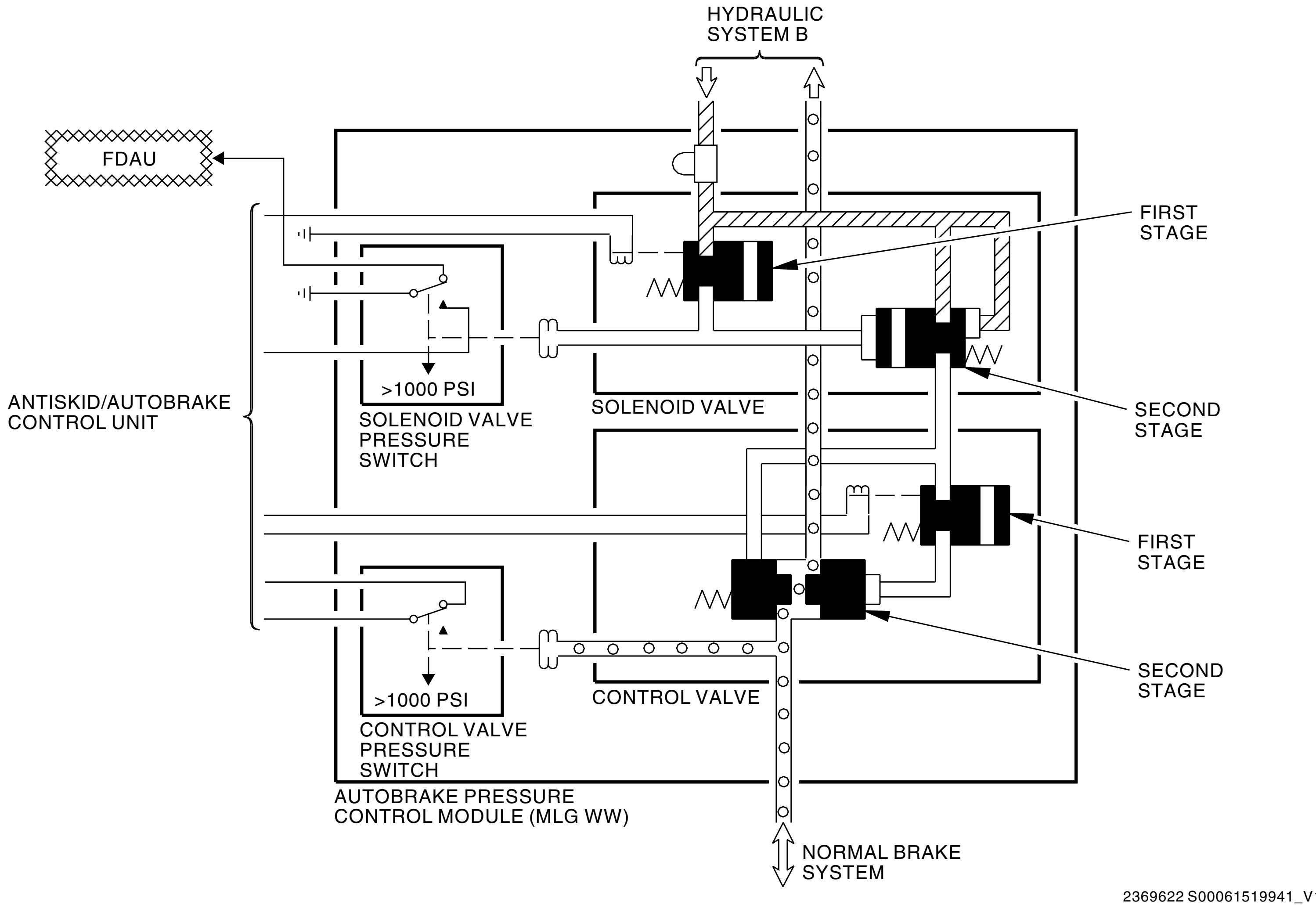
The AACU uses the control valve pressure switch to monitor the pressure from the control valve for faults. The pressure switch opens when control pressure from the control valve is less than 1000 psi.

Functional Description

When you move the AUTO BRAKE select switch to the 1, 2, 3, MAX, or RTO positions, it sends the selected position to the AACU.

The AACU sends signals to the first stage of the solenoid valve and the first stage of the control valve to apply the autobrakes. Pressure then goes to operate the second stage of both valves. This sends autobrake pressure to the brakes.

The solenoid and control valve pressure switches monitor the valves for correct operation. The AACU disarms the autobrakes if one of the valves has a fault.



ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE PRESSURE CONTROL MODULE - FUNCTIONAL DESCRIPTION

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE SHUTTLE VALVES

Purpose

Two autobrake shuttle valves select the highest of autobrake or normal metered pressures and send it to the brakes.

Location

The autobrake shuttle valves are on the aft bulkhead of the main landing gear wheel well.

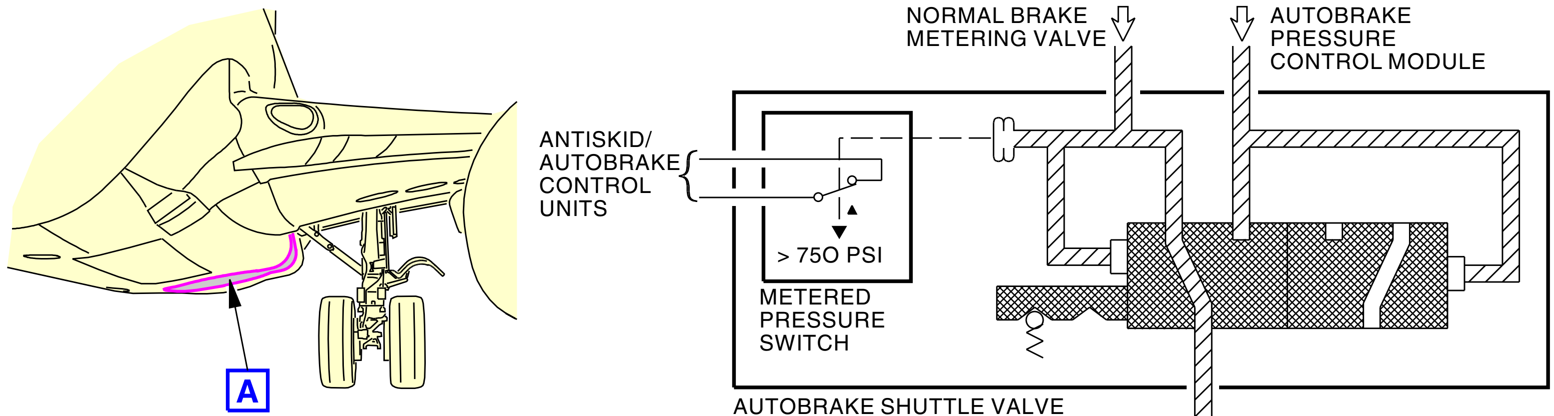
Physical Description

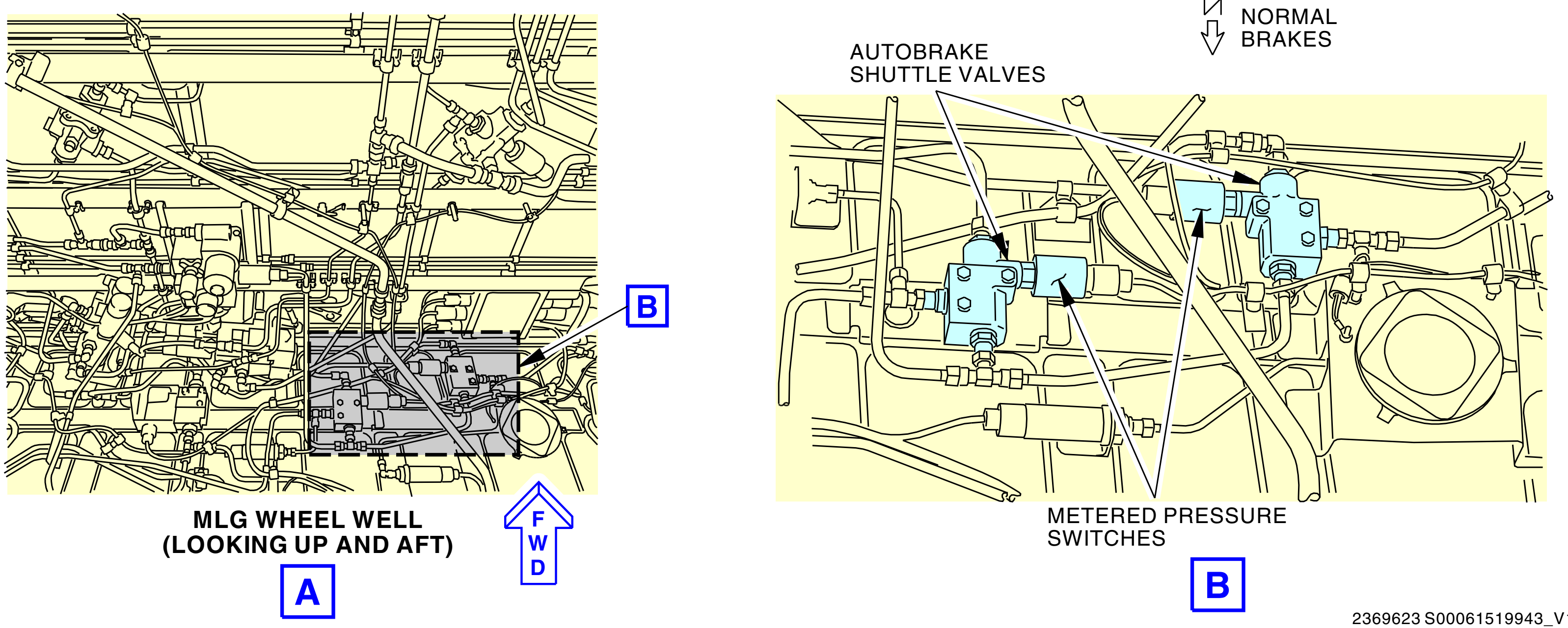
The valves are un-biased shuttle valves with detents. The valves are interchangeable.

Functional Description

The metered pressure switch sends signals to the antiskid/autobrake control unit when the pressure from the normal brake metering valve increases to more than 750 psi. The antiskid/autobrake control unit uses this signal to disarm the operation of the autobrakes.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE SHUTTLE VALVES





MLG WHEEL WELL
(LOOKING UP AND AFT)
A

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ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE SHUTTLE VALVES

ANTISKID/AUTOBRAKE SYSTEM - CONTROLS AND INDICATIONS

Purpose

The AUTO BRAKE select switch lets the pilots select a landing autobrake deceleration rate, or autobrake operation if a rejected takeoff occurs.

The AUTO BRAKE DISARM amber light shows that there is a disarm condition in the autobrake system.

Location

The AUTO BRAKE select switch is on the P2 center instrument panel above the upper center display unit.

The AUTO BRAKE DISARM light is above the AUTO BRAKE select switch.

Functional Description

The AUTO BRAKE select switch is a six position selector switch.

Positions 1 through MAX command the rate of deceleration for autobrake operation after an airplane lands. You must pull on the select switch to move it to the MAX position.

The RTO position commands maximum brake pressure when the pilot does a rejected takeoff.

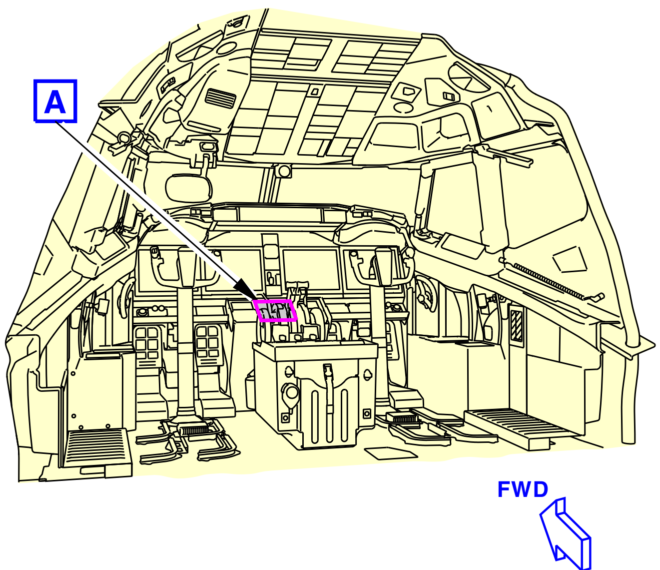
When the AUTO BRAKE select switch is in the 1, 2, 3, or MAX position, the AUTO BRAKE DISARM amber light comes on for these conditions:

- Landing disarm logic true
- RTO turn on self check
- RTO disarm logic true when RTO autobrakes have been applied
- Within 1.4 seconds after touchdown if the selector was in the RTO position since takeoff
- RTO autobrake commanded to apply and the autobrake solenoid valve pressure is low.

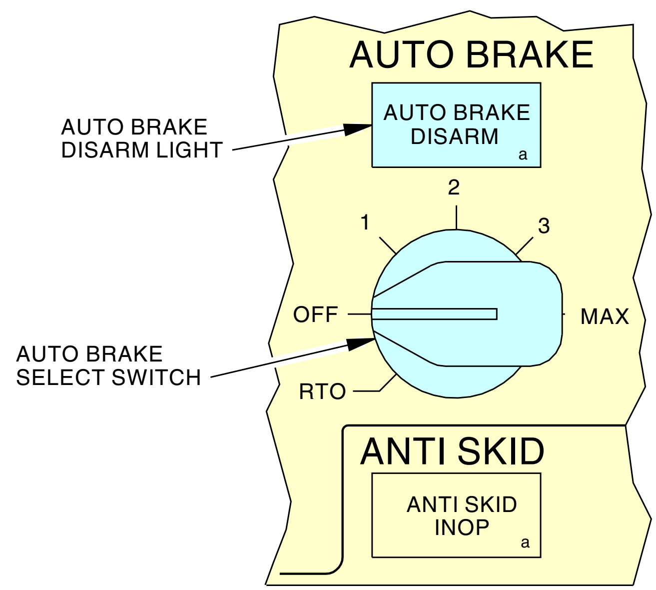
The AUTO BRAKE DISARM amber light also comes on when the AUTO BRAKE select switch is in the OFF position and the solenoid valve pressure increases more than 1000 psi.

Move the AUTO BRAKE select switch to the OFF position to turn the AUTO BRAKE DISARM amber light off.

ANTISKID/AUTOBRAKE SYSTEM - CONTROLS AND INDICATIONS



FLIGHT COMPARTMENT



AUTOBRAKE/ANTISKID PANEL (P2)

A

2369624 S00061519945_V2

ANTISKID/AUTOBRAKE SYSTEM - CONTROLS AND INDICATIONS

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - ANTISKID CONTROL - 1

General

Two antiskid cards supply antiskid control. One antiskid card supplies the antiskid function for the outboard wheels and the other antiskid card supplies the antiskid function for the inboard wheels.

Each antiskid card gets wheel speed signals from two transducers. The left ADIRU sends a ground speed signal to the outboard antiskid card. The right ADIRU sends a ground speed signal to the inboard antiskid card.

Each antiskid card controls two normal and one alternate valve. The normal and alternate valves get commands at the same time.

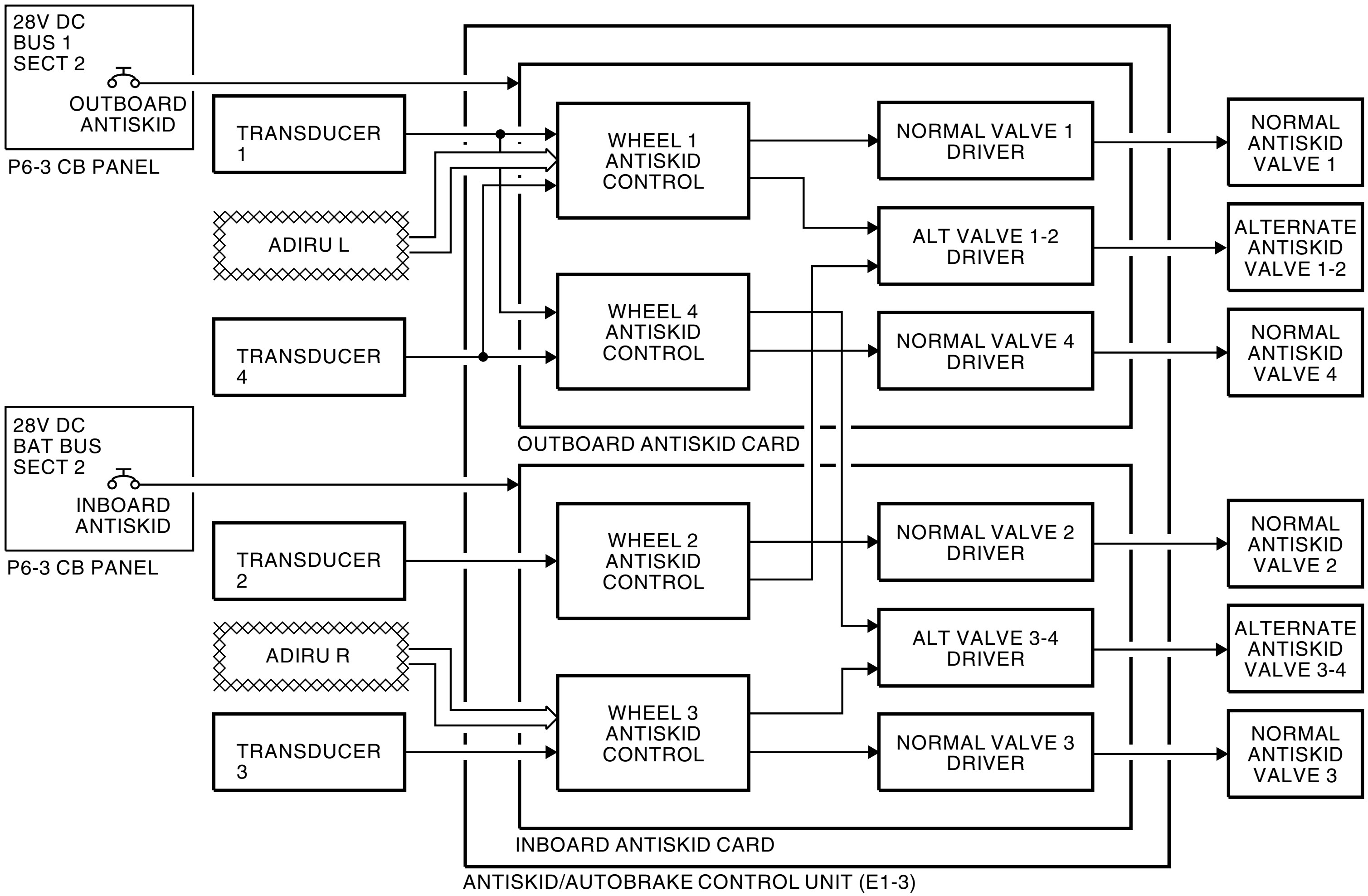
Normal Antiskid

When a skid condition occurs, the antiskid system sends a signal from the normal valve driver on the antiskid card to the normal antiskid valve.

Alternate Antiskid

The signals sent to both normal valve drivers also go to the alternate valve driver for those two wheels. The alternate valve driver then sends the higher of the two signals to the alternate antiskid valve.

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - ANTISKID CONTROL - 1



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ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - ANTISKID CONTROL - 1

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - ANTISKID CONTROL - 2

General

The antiskid card has these functions:

- Skid control
- Locked wheel protection
- Touchdown protection
- Touchdown/hydroplane protection
- Gear retract braking inhibit.

Skid Control

Skid control compares the calculated wheel speed velocity with a velocity model to control wheel deceleration. If a wheel slows down too quickly, the skid control releases brake pressure until the wheel speed increases.

Skid control does not operate at less than a speed of eight knots.

During normal antiskid operation, the skid control operates for each wheel. During alternate antiskid operation, the skid control operates for both wheels on one main landing gear.

Locked Wheel Protection

Locked wheel protection compares the wheel speeds of the two outboard or the two inboard pair of wheels.

If the slower wheel speed decreases to less than 30 percent of the faster wheel speed, the locked wheel protection releases brake pressure from the slower wheel. Locked wheel protection does not operate at a speed less than 25 knots.

Touchdown Protection

The touchdown protection releases brake pressure from wheels 2 and 4 while the airplane is in the air and remains active until 0.7 seconds after the corresponding wheel spins up to 70 knots, or when the ground mode has been sensed continuously for three (3) seconds. The PSEU supplies the air or ground signals to the AACU, (system 1 for wheel 2 and system 2 for wheel 4).

Touchdown/Hydroplane Protection

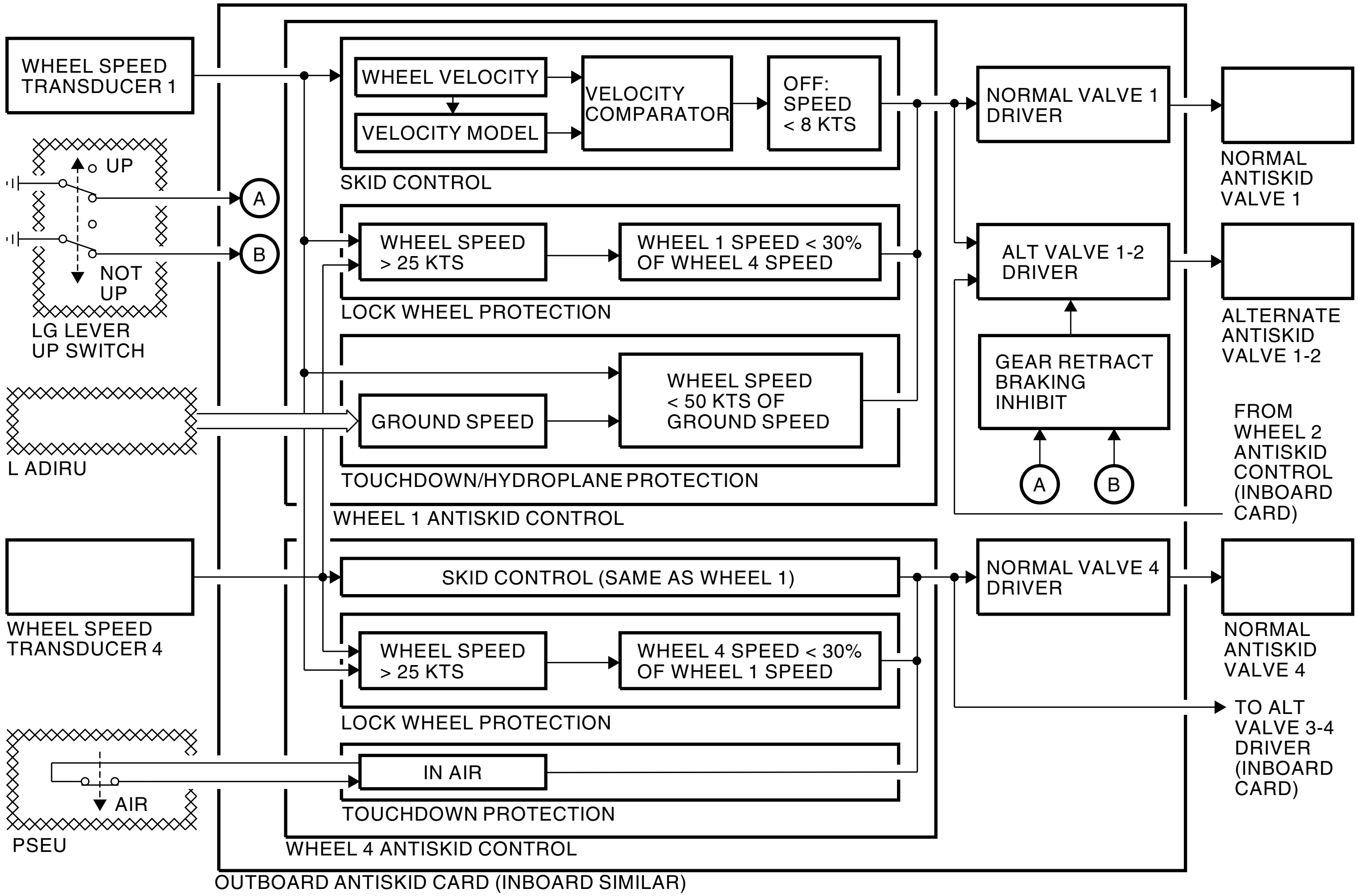
The touchdown/hydroplane protection compares wheel speed data to ADIRU ground speed data. When the wheel speed decreases to 50 knots less than ground speed, the touchdown/hydroplane protection releases pressure to the brake. The hydroplane function supplies protection to wheels 1 and 3 only.

Gear Retract Inhibit

To permit gear retract braking, the antiskid system stops alternate antiskid operation during landing gear retraction. This occurs during the 12.5 seconds after the landing gear lever moves to the UP position.

This permits gear retract braking to stop the wheels during landing gear retraction without antiskid brake release.

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - ANTISKID CONTROL - 2



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ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - ANTISKID CONTROL - 2

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - FAULT INDICATION

General

The BITE card in the antiskid/autobrake control unit (AACU) sends fault signals through relays to the flight compartment.

Fault Indication

The amber ANTISKID INOP light comes on if there is a fault. The light can get a ground from one of these antiskid sense relays:

- Outboard
- Inboard
- Alternate.

When the BITE card in the AACU finds a fault in the normal inboard or normal outboard antiskid, it removes the ground from the related sense relay. The sense relay deenergizes, which sends a ground to make the amber ANTISKID INOP light come on. The alternate antiskid sense relay is enabled when pressure is sensed at the alternate brake selector valve pressure switch.

The alternate brake selector valve pressure switch also sends signals to the flight data aquisition unit (FDAU).

See the flight data recording system (FDRS) section for more information about the FDAU. (SECTION 31-31)

The amber ANTISKID INOP light comes on for these conditions:

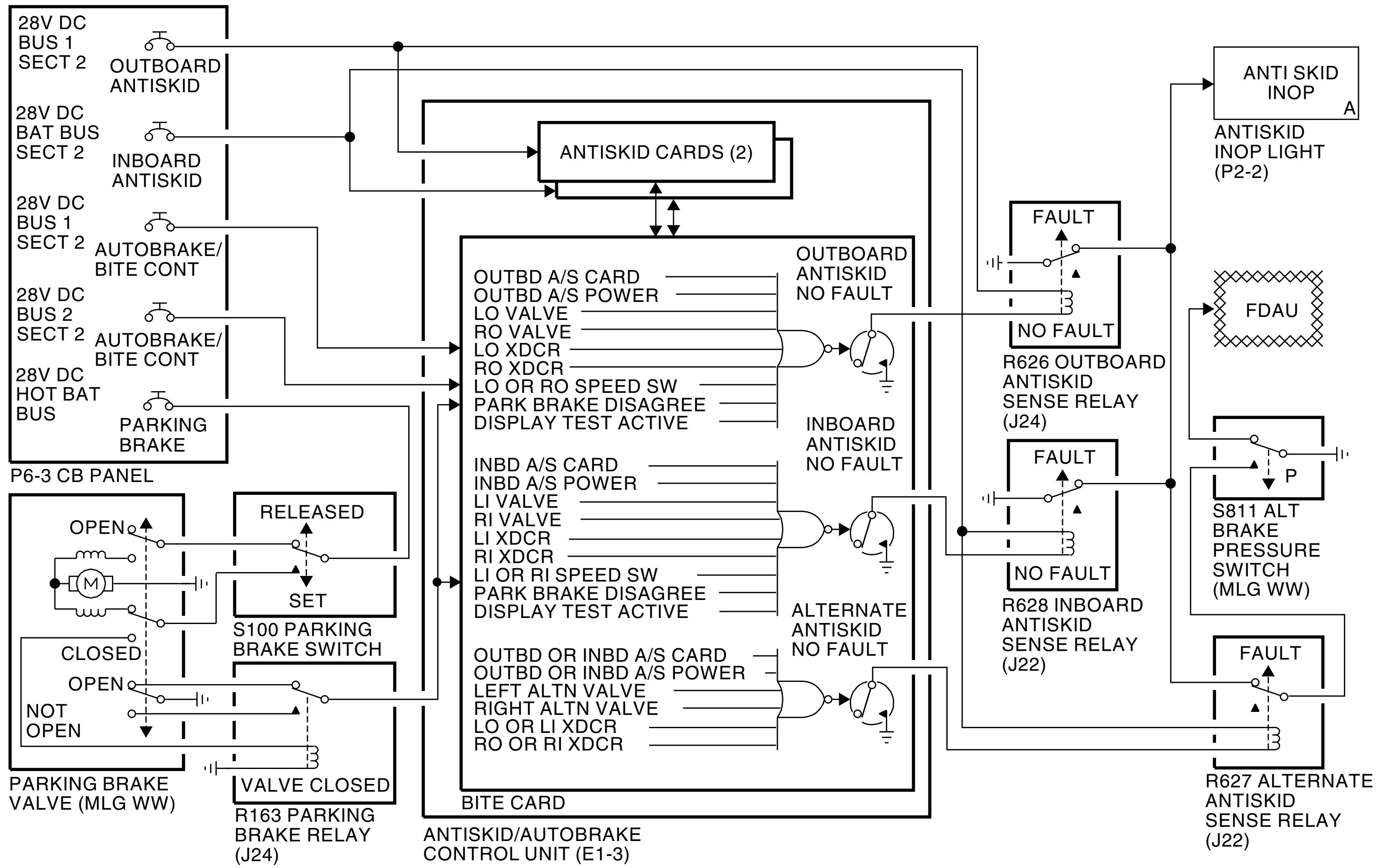
- Inboard or outboard antiskid card fault
- Inboard or outboard antiskid power fault
- One or more normal antiskid valve faults
- Speed switch fault (high wheel speed in air)
- One or more transducer faults
- Parking brake lever and parking brake shutoff valve disagree
- Display test active.

The normal antiskid valves release unwanted brake pressure through the parking brake valve. Therefore, the antiskid system monitors the parking brake system for a fault. When the parking brake valve is not in its commanded position, the parking brake relay does not send a ground to the AACU. This causes a fault in the outboard and inboard antiskid, and the amber ANTISKID INOP light comes on.

The amber ANTISKID INOP light also comes on for these conditions if the alternate brake selector valve is pressurized:

- Inboard or outboard antiskid card fault
- Inboard or outboard antiskid power fault
- One or more transducer faults
- Alternate antiskid valve fault.

ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - FAULT INDICATION



ANTISKID/AUTOBRAKE SYSTEM - ANTISKID FUNCTIONAL DESCRIPTION - FAULT INDICATION

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - AUTOBRAKE CONTROL

General

The antiskid/autobrake control unit (AACU) uses the autobrake card to control the autobrake system for landing and rejected takeoff.

The antiskid/autobrake control unit gets power from bus 1 and 2 main dc buses. This power also goes to the AUTO BRAKE select switch.

Functional Description

When you move the AUTO BRAKE select switch to the OFF position, it sends power to energize the autobrake disarm relay to the reset position. The 1, 2, 3, MAX, or RTO contacts on the select switch send the select switch position data to the AACU.

When all the conditions for arming the system occur, the AACU sends power to the autobrake pressure control module to control autobrake pressure to the brake system. This slows and stops the airplane at the deceleration rate the pilot selects.

These components send signals to the AACU:

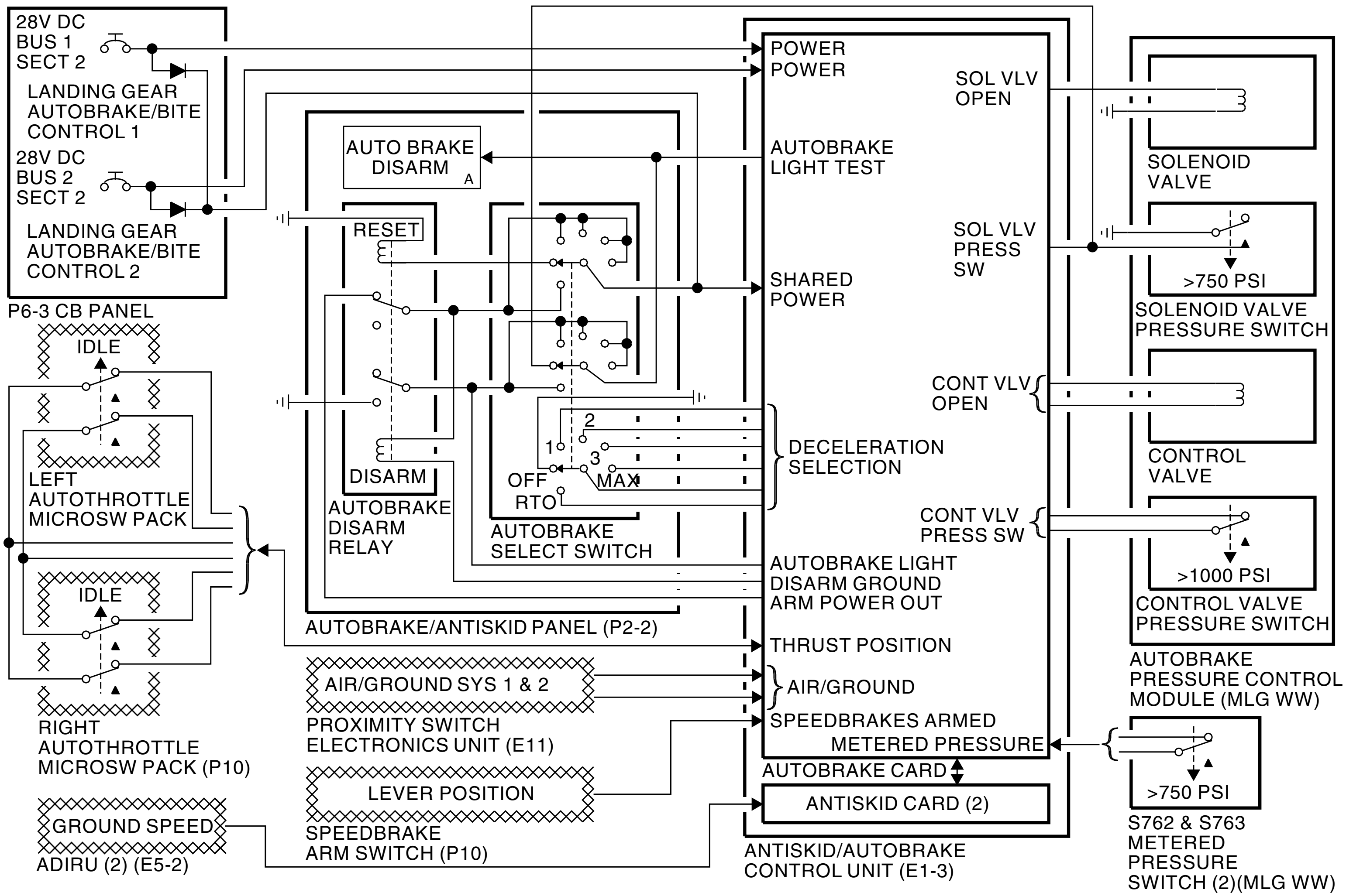
- Thrust lever position from the autothrottle microswitch packs
- Air/ground from the proximity switch electronics unit
- Speed brake lever arm switch
- Metered pressure switches
- Ground speed from the air data inertial reference unit
- Control valve pressure switch monitored for faults in the autobrake pressure control module control valve
- Solenoid valve pressure switch monitored for faults in the autobrake pressure control module solenoid valve.

These switches are used for arm and disarm of the autobrake operation.

When a disarm condition occurs, the AACU removes power from the solenoid and control valves on the autobrake pressure control module. It also sends a ground to energize the autobrake disarm relay to the disarm position. The disarm relay sends a ground to make the AUTO BRAKE DISARM light come on.

To reset the autobrake disarm relay, move the AUTO BRAKE select switch to the OFF position. This will turn the amber AUTO BRAKE DISARM light off when the autobrake system is disarmed, and the AUTO BRAKE select switch is not in the OFF position.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - AUTOBRAKE CONTROL



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ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - AUTOBRAKE CONTROL

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - LANDING ARM & APPLICATION LOGIC

General

The autobrake system controls autobrake pressure to stop the airplane at the selected deceleration rate.

Landing Arm Logic

The autobrake system arms for landing when all of these conditions occur:

- You move the AUTO BRAKE select switch to a landing deceleration position (1, 2, 3, or MAX)
- Both air/ground systems in air mode, or both thrust levers at idle, or one or both air/ground systems in the ground mode for less than or equal to three seconds
- Valid input from left ADIRU
- No fault in the autobrake system
- No fault in the normal antiskid system
- Normal brake metered pressure less than 750 psi.

When you move the AUTO BRAKE select switch to 1, 2, 3, or MAX and one or more of the arm conditions is not true, the select switch stays in the selected position and the AUTO BRAKE DISARM light comes on.

Landing Application Logic

The autobrake function applies the brakes when these conditions occur:

- Landing autobrake is armed
- Both thrust levers at idle
- Either air/ground system continuously indicates ground for 0.2 seconds (if wheel spin-up occurs more than one second before ground is sensed) or 0.7 seconds (if wheel spin-up is occurs less than one second before ground is sensed).
- Wheel spin-up detection occurs or the spin-up latch sets.

Wheel spin-up detection occurs when one wheel on each main landing gear increases to 60 kts or greater and the wheel speed stays above 30 kts.

The spin-up latch sets 3 seconds after the air/ground system is in the ground mode and the wheel spin-up detection occurs. The spin-up latch resets when the air/ground system is in the air mode or the autobrake system is off or in the disarm mode.

When the landing autobrake function applies the brakes, it energizes the valve relay in the antiskid/autobrake control unit. This sends power to the solenoid valve and control valve on the autobrake pressure control module.

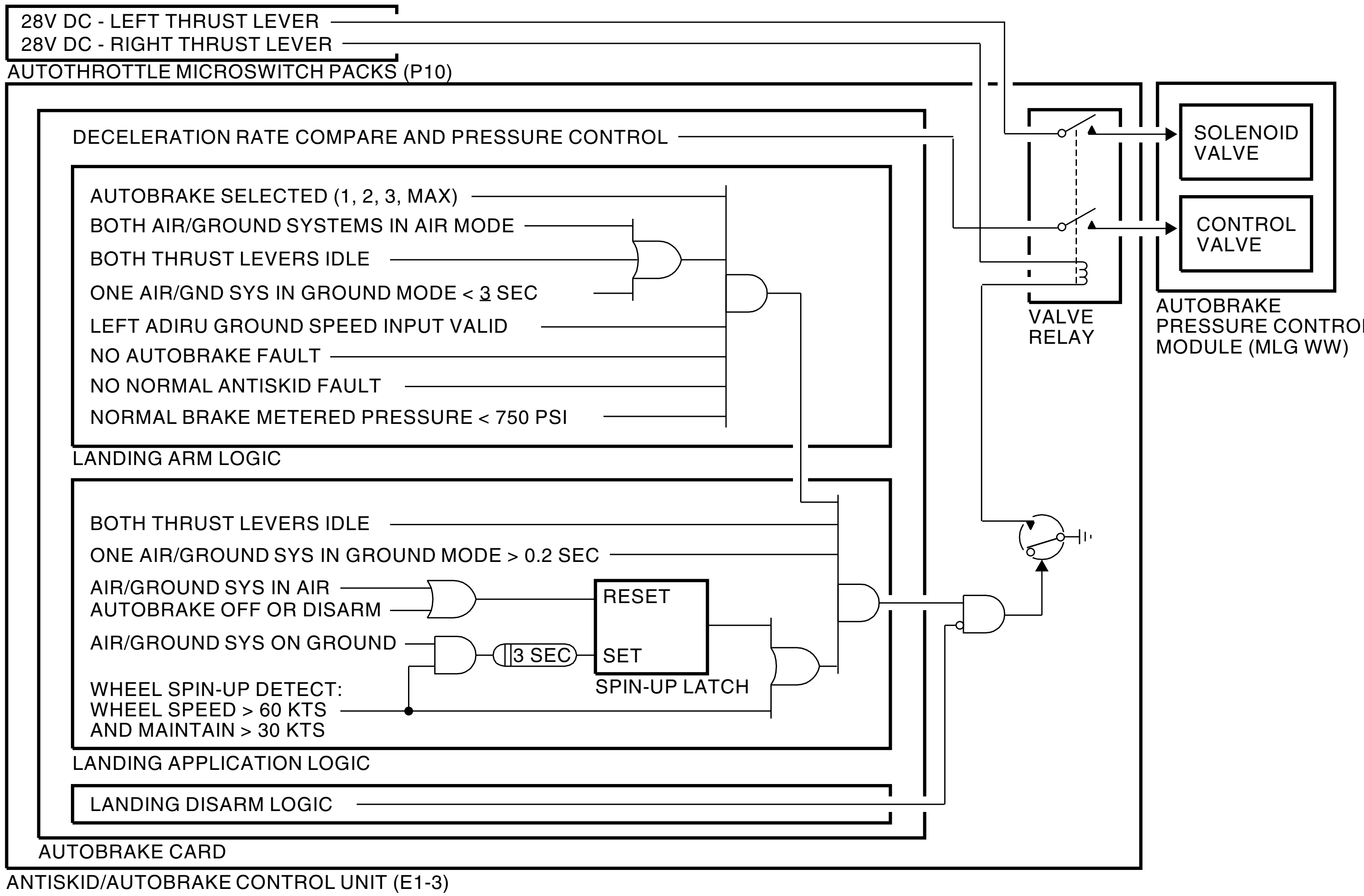
While autobrake application occurs, you can change the rate of deceleration and not disarm the system.

These are the deceleration rates and brake pressures for each position of the autobrake selector switch:

AUTO BRAKE Select Switch	Deceleration Rate (ft/sec/sec)	Pressure (psi)
1	4	1285
2	5	1500
3	7.2	2000
MAX	14 (> 80 knots) 12 (< 80 knots)	3000

If one or more of the arm conditions are not true while the autobrakes apply the brakes, the AUTO BRAKE select switch stays in the selected position and the AUTO BRAKE DISARM light comes on.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - LANDING ARM & APPLICATION LOGIC



2369629 S00061519955_V2

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - LANDING ARM & APPLICATION LOGIC

Landing Disarm Logic

The autobrake system releases the landing autobrakes and disarms the autobrake system when any of these conditions occur:

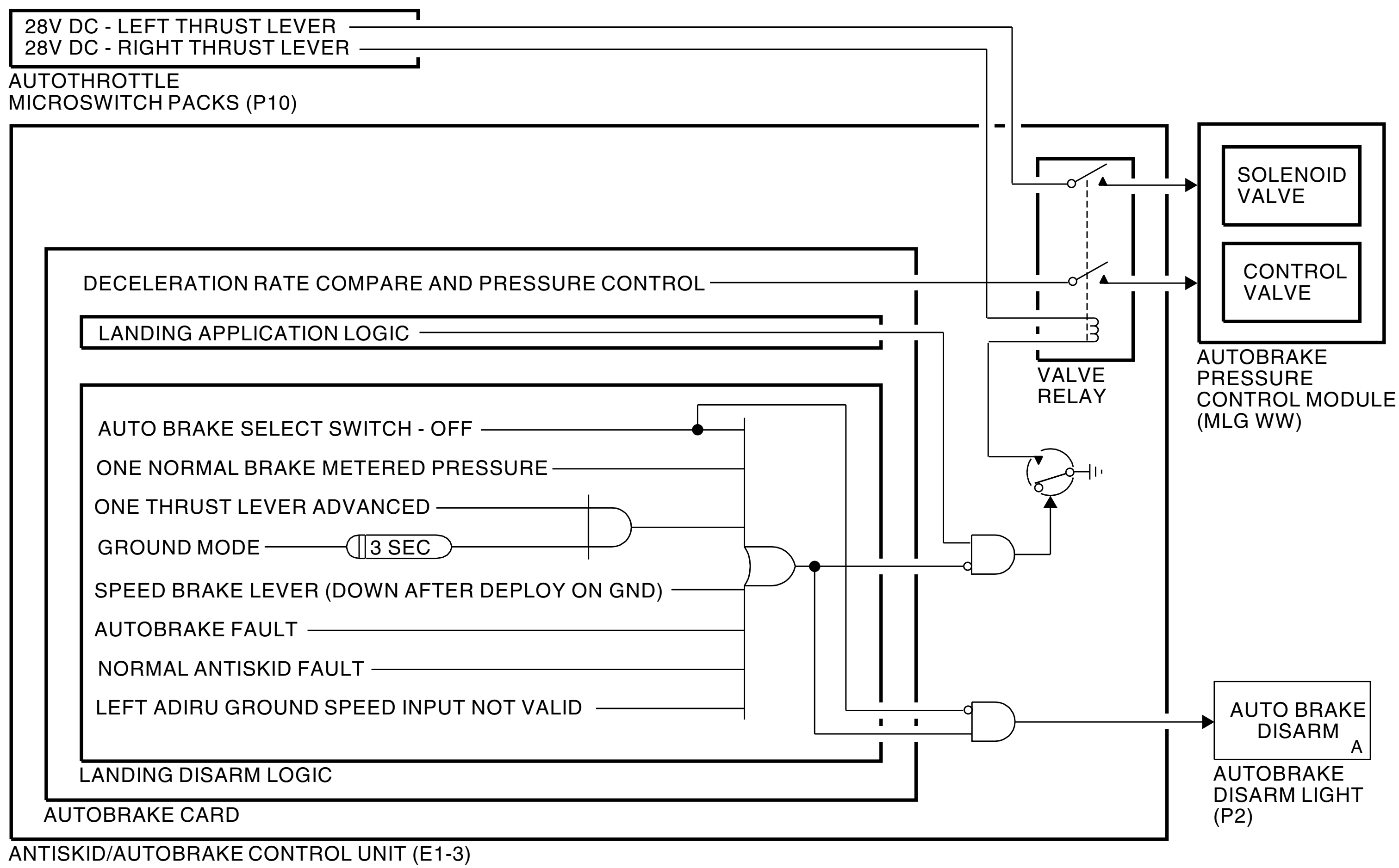
- AUTO BRAKE select switch to the OFF position
- One normal metered pressure is more than 750 psi
- One thrust lever advanced out of the idle position after the airplane is on the ground for more that 3 seconds (before 3 seconds causes brake release with no disarm)
- Speedbrake lever from the UP position to the DOWN position
- Fault in the normal antiskid system
- Fault in the autobrake system
- Input from left ADIRU not valid.

When disarmed, the system sends a signal to the AUTO BRAKE DISARM light, and the light comes on (except for the first condition, when you move the AUTO BRAKE select switch to OFF).

Move the AUTO BRAKE select switch to the OFF position to make the light not come on.

NOTE: Hydroplane protection on the antiskid cards uses both ADIRUs ground speeds. With the R ADIRU failed, landing autobrakes may be armed for landing. However, you would see R ADIRU fault on the AACU front panel.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - LANDING DISARM LOGIC



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ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - LANDING DISARM LOGIC

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - RTO ARM AND APPLICATION LOGIC

RTO Arm Logic

When you move the AUTO BRAKE select switch to the Refused Take Off (RTO) position, the antiskid/autobrake control unit starts a turn-on self check. The autobrake system arms for the RTO autobrake function when all of the these turn-on self check conditions occur:

- AUTO BRAKE select switch to the RTO position
- No fault in the RTO autobrake function
- Two air ground systems in the ground mode
- Average of all wheel speeds less than 60 knots (111 km/h)
- No fault in the normal antiskid system
- Two thrust levers are in the idle position
- Solenoid and control valve pressures less than 1000 psi (70 kg/cm^2).

The turn-on self check also does a test of the antiskid/autobrake control unit and related components. While the turn-on self check operates, the AUTO BRAKE DISARM light comes on for 1.4 seconds. If the turn-on self check fails, the RTO autobrakes do not arm and the AUTO BRAKE DISARM light stays on.

NOTE: On the ground before takeoff, arming the autobrakes for RTO does not require either ADIRU. During takeoff at 88 knots (163 km/h), when autobrakes are initially enabled, only the left ADIRU is required for ground speed crosscheck, however, subsequently both ADIRUs are required for crosscheck.

RTO Application Logic

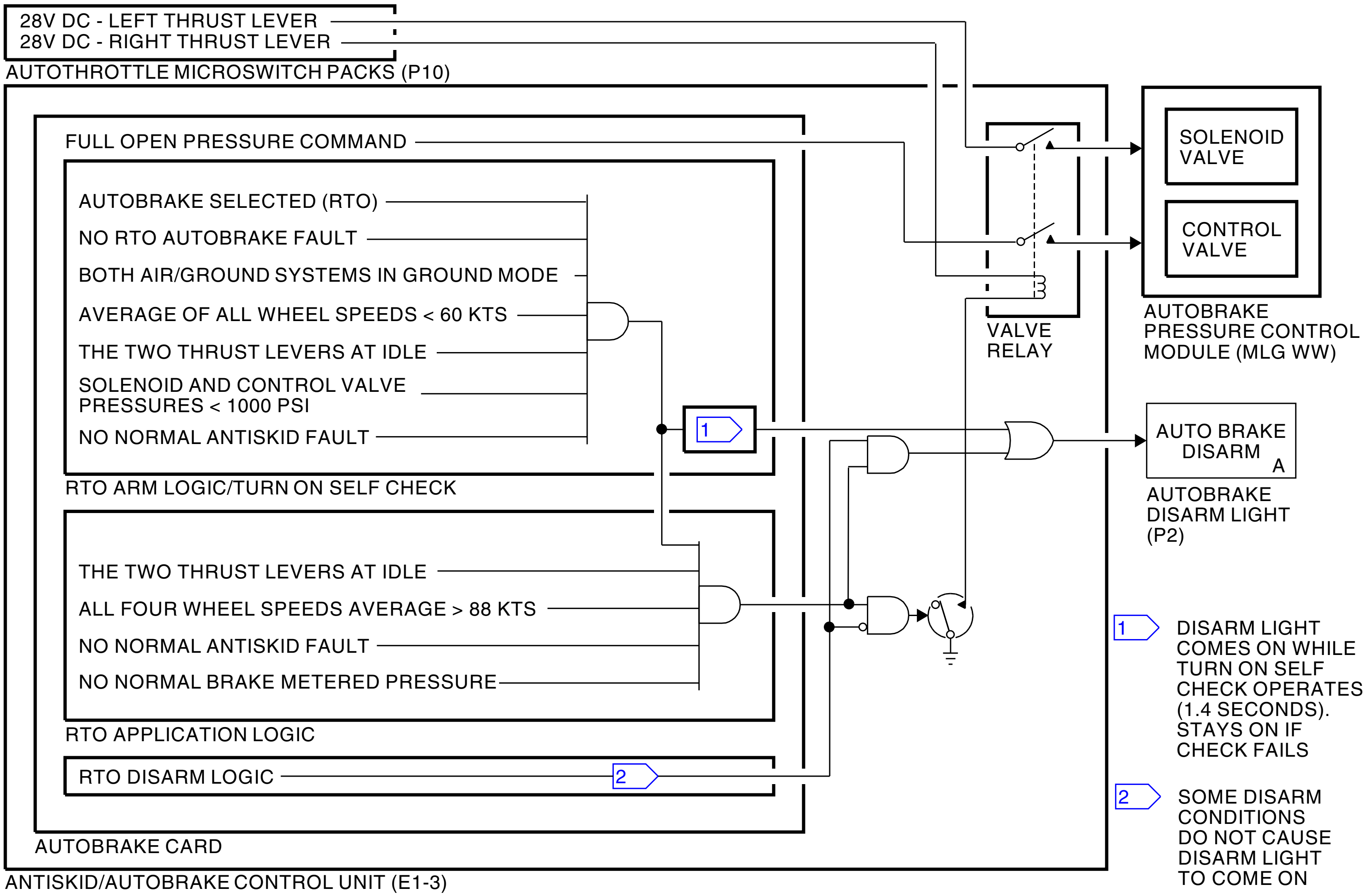
The autobrake function applies the brakes when these conditions occur:

- RTO autobrake is armed
- Two thrust levers are in the idle position
- All wheel speeds average more than 88 knots (163 km/h)
- No fault in the normal antiskid system
- Two normal metered pressures are less than 750 psi (53 kg/cm^2).

When the RTO autobrake function applies the brakes, it energizes a relay in the antiskid/autobrake control unit. This sends power to the solenoid and control valves on the autobrake pressure control module.

The autobrake system sends full hydraulic pressure to the brakes to slow and stop the airplane.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - RTO ARM AND APPLICATION LOGIC



2369631 S00061519959_V1

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - RTO ARM AND APPLICATION LOGIC

RTO Disarm Logic

The autobrake system releases the RTO autobrakes (if they were applied) and disarms the autobrake system (the AUTO BRAKE DISARM light does not come on) when any of these conditions occur:

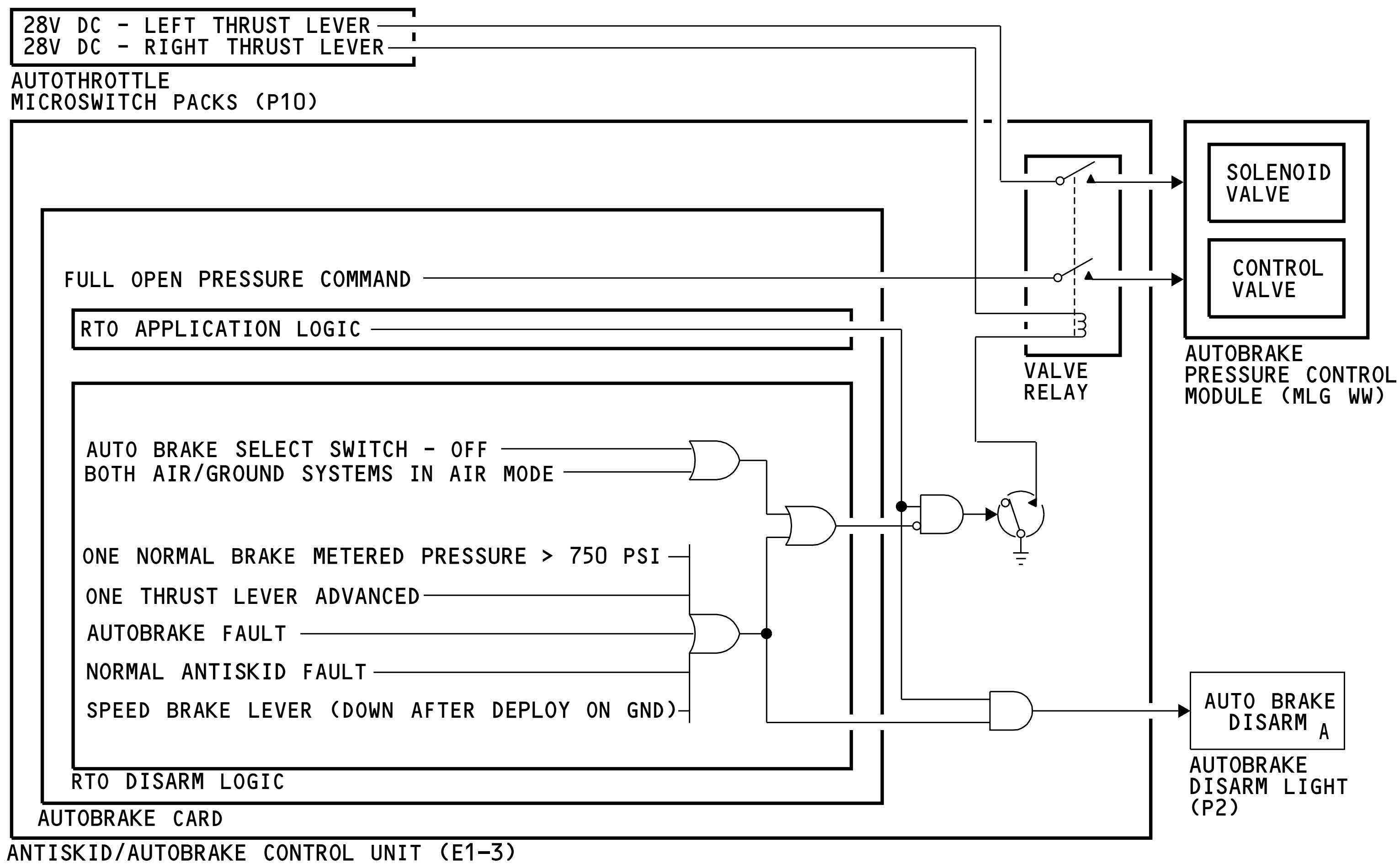
- AUTO BRAKE select switch to the OFF position
- Two air/ground systems are in the air mode.

If RTO autobrake was applied, the autobrake system releases the RTO autobrakes and disarms the autobrake system (the AUTO BRAKE DISARM light comes on) when any of these conditions occur:

- One or both normal metered pressure more than 750 psi
- One or both thrust levers at more than idle position
- Fault in the autobrake system
- Fault in the normal antiskid system
- Speedbrake lever moved from the UP position to the DOWN position.

Move the AUTO BRAKE select switch to the OFF position to make the light go off.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - RTO DISARM LOGIC



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ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - RTO DISARM LOGIC

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - FAULT INDICATION

General

The antiskid/autobrake control unit (AACU) gets power from bus 1 and 2 main dc buses. Power goes to the BITE card and AUTOBRAKE card. Power also goes to the AUTOBRAKE select switch.

The BITE card in the AACU sends fault signals through the AUTOBRAKE card to the antiskid/autobrake panel in the flight compartment. This controls the amber AUTO BRAKE DISARM light. The AUTO BRAKE DISARM light receives power from the master dim and test system (not shown).

Fault Indication

The amber AUTOBRAKE DISARM light comes on if there is a fault. The light can get a ground from one of these components:

- Autobrake pressure control module solenoid valve pressure switch
- Autobrake light logic switch
- Autobrake disarm relay
- Autobrake light test

The autobrake disarm ground logic switch controls the autobrake disarm relay.

The amber AUTO BRAKE DISARM light comes on for these autobrake/antiskid conditions:

- Autobrake select switch to OFF and the autobrake pressure control module solenoid valve pressure more than 1000 psi (6895 kPa)
- Autobrake select switch to 1, 2, 3, MAX, or RTO and the autobrake light logic switch energize
- Autobrake select switch to 1, 2, 3, MAX, or RTO and the autobrake disarm relay energized
- AUTO BRAKE DISARM light test in the AACU

When the BITE card in the AACU finds a fault in the antiskid system, it sends a signal to the autobrake disarm ground logic and autobrake light logic on the autobrake card. The BITE card also sends a signal to the ANTI SKID INOP light.

The autobrake disarm ground logic switch gives a ground for the autobrake disarm relay for one or more of these conditions:

- Autobrake selected and the landing autobrake disarm logic is true
- RTO autobrake operation fault
- No RTO autobrake operation fault and the RTO autobrake disarm logic is true
- RTO autobrake is selected, and the signal from the proximity switch electronics unit (PSEU) shows on-ground for 1.4 seconds

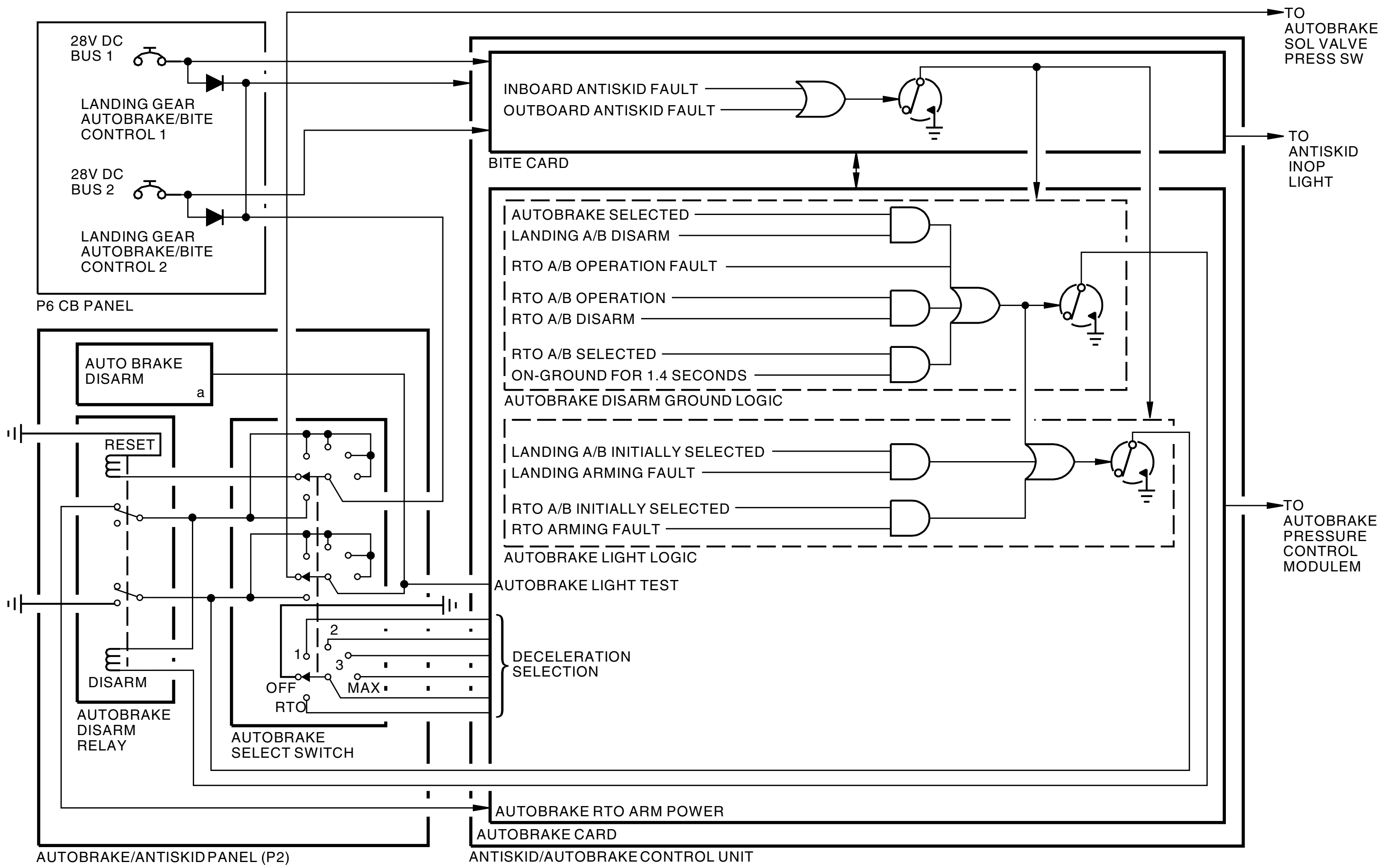
The autobrake disarm relay gets a reset when the AUTOBRAKE select switch moves to OFF

The autobrake light logic switch gives a ground for the amber AUTO BRAKE DISARM light for one or more of these conditions:

- Autobrake disarm ground logic true
- Landing autobrake is initially selected, and there is a landing arming fault
- RTO autobrake is initially selected, and there is an RTO arming fault

The autobrake light test is done during initial power-up of the AACU and during BITE tests.

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - FAULT INDICATION



2369634 S00061519965_V1

ANTISKID/AUTOBRAKE SYSTEM - AUTOBRAKE FUNCTIONAL DESCRIPTION - FAULT INDICATION

ANTISKID/AUTOBRAKE SYSTEM - ENGINE THROTTLE SWITCHES

Purpose

The engine throttle switches supply data to the antiskid/autobrake control unit (AACU) for the autobrake function. The AACU uses this data to arm or disarm the autobrakes after landing.

Location

The engine throttle switches are on the autothrottle switchpacks below the control stand. To get access, go through access panels in the overhead of the nose landing gear wheel well.

Physical Description

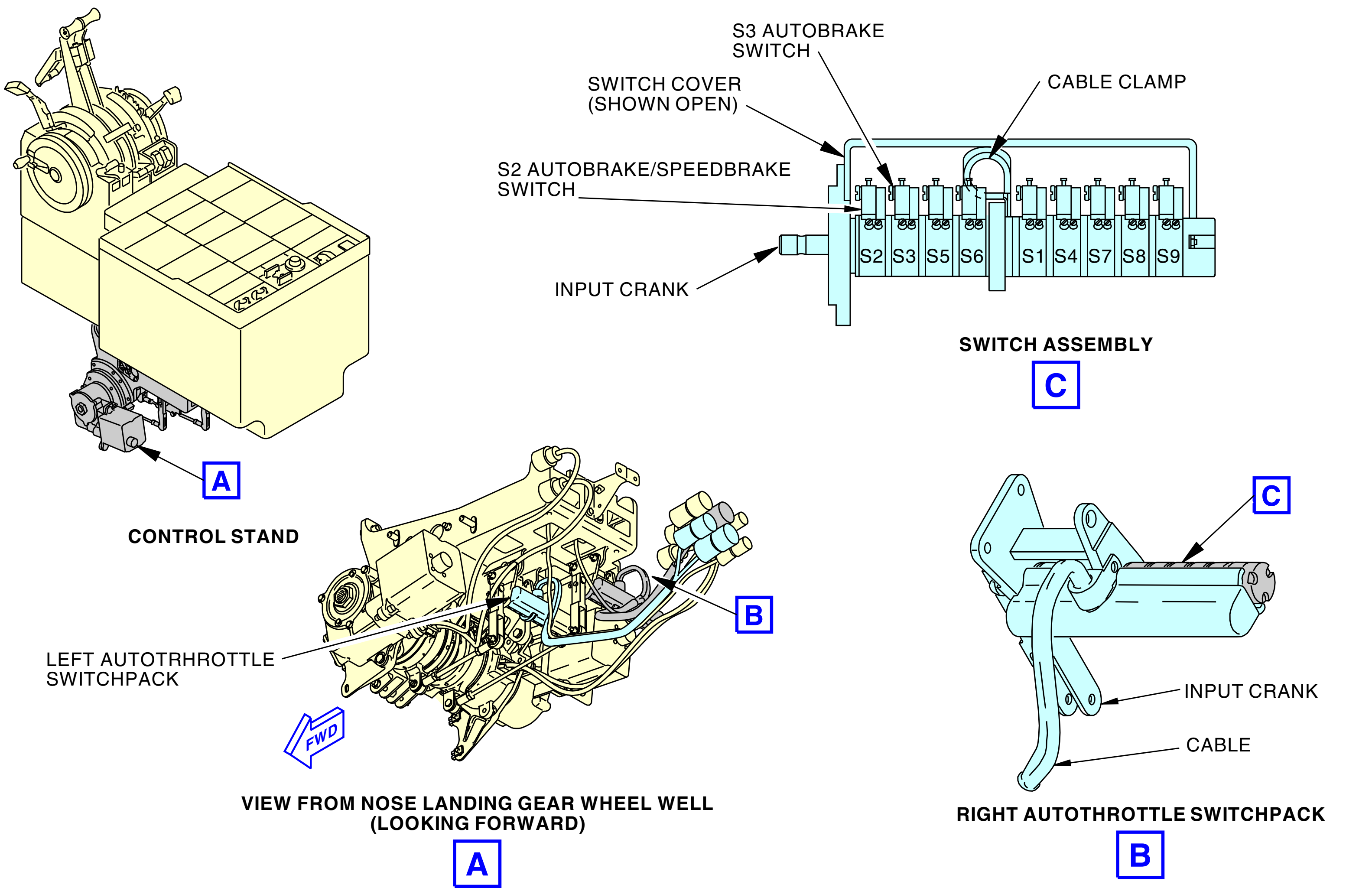
The engine throttle switches operate when the thrust levers move less than the idle position (less than 44 degrees of thrust resolver angle rotation (TRA)).

Functional Description

This table gives you data about the autobrake switches:

Name	Switch	TRA Position
Autobrake System	S2	RET < 44 Autobrake Arm Logic Enabled
Autobrake System	S3	RET < 44 Autobrake Arm Logic Enabled

ANTISKID/AUTOBRAKE SYSTEM - ENGINE THROTTLE SWITCHES



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ANTISKID/AUTOBRAKE SYSTEM - ENGINE THROTTLE SWITCHES

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PARKING BRAKE SYSTEM - INTRODUCTION

Purpose

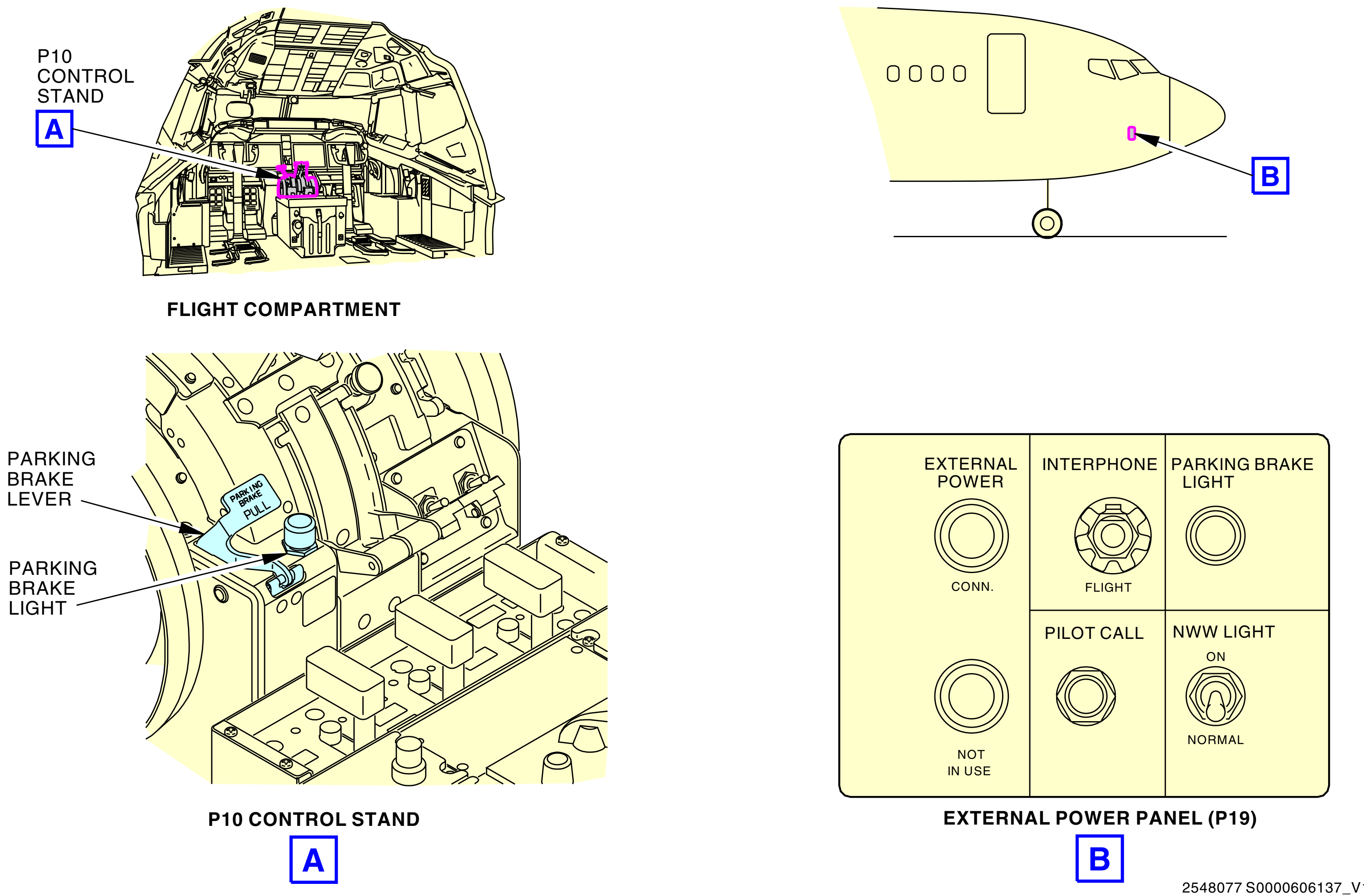
The parking brake system uses the normal hydraulic brake system to keep the main landing gear brakes applied when you park the airplane.

Parking Brake System Indication

A red parking brake light adjacent to the parking brake lever shows the condition of the parking brake system.

A light on the external power panel also shows the condition of the parking brake system.

PARKING BRAKE SYSTEM - INTRODUCTION



PARKING BRAKE SYSTEM - INTRODUCTION

PARKING BRAKE SYSTEM - GENERAL DESCRIPTION

Components

These are the parking brake system components:

- Parking brake lever
- Parking brake linkage
- Parking brake switch
- Parking brake light
- Parking brake repeater light
- Parking brake close sense relay
- Parking brake shutoff valve.

General Description

When you push the brake pedals and pull the parking brake lever, the linkage latches the brake pedals in the brakes-applied position. This operates the brake metering valves, which supply pressure to the brakes.

The parking brake switch sends a signal to close the parking brake shutoff valve. The switch sends a parking brake set signal to the proximity switch electronics unit.

The parking brake switch also sends a signal to the parking brake repeater light on the external power panel.

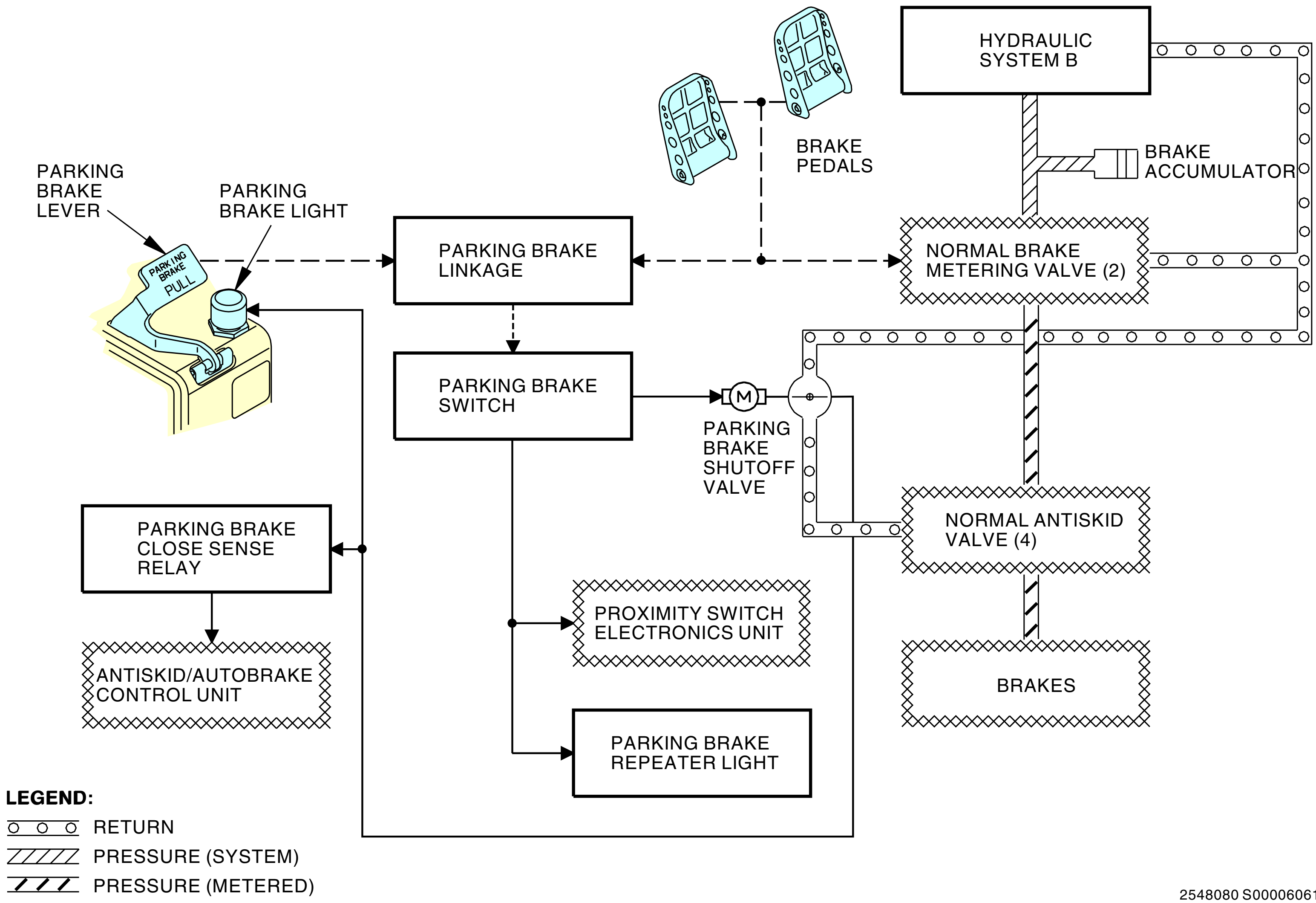
The parking brake shutoff valve does not let brake pressure leak from the return of the normal antiskid valves.

The parking brake shutoff valve sends a signal to operate the parking brake light. The valve also sends a signal through the parking brake close sense relay to the antiskid/autobrake control unit.

A fully charged (3000 psi) brake accumulator keeps the brakes pressurized at least eight hours. Use chocks around both outboard main landing gear wheels when you park the airplane more than eight hours.

To release the parking brake, push the brake pedals until the parking brake lever moves down, then release the brake pedals. This sends brake metered pressure to the hydraulic system return through the brake metering valves.

PARKING BRAKE SYSTEM - GENERAL DESCRIPTION



2548080 S0000606138_V1

PARKING BRAKE SYSTEM - GENERAL DESCRIPTION

PARKING BRAKE SYSTEM - LINKAGE

Purpose

The parking brake linkage mechanically locks the brake pedals in the applied position.

These are the parking brake linkage components:

- Parking brake lever
- Parking brake switch
- Latch pawls (2)
- Return spring.

Location

The parking brake linkage is in the forward equipment compartment below the captain brake pedals.

The parking brake switch is on the parking brake linkage.

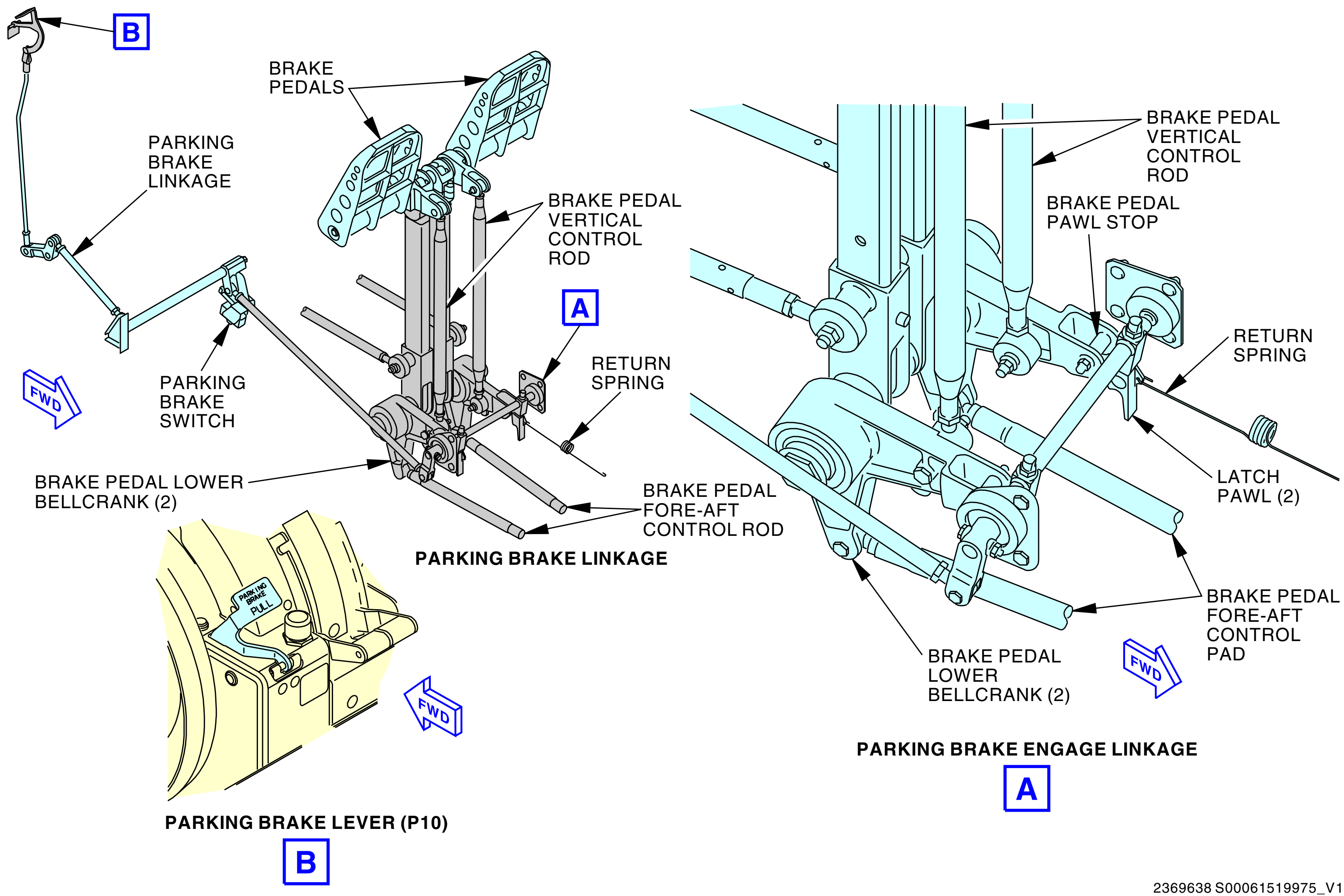
Functional Description

When you push the brake pedals and pull the parking brake lever up, these things occur:

- The brake pedals move the vertical control rods down
- The vertical control rods move the pawl stop down
- The parking brake lever moves the linkage and the bellcrank
- The bellcrank turns the latch pawl
- The latch pawl holds the pawl stop down when the brake pedals are released
- The parking brake switch moves to the closed position
- You can then release the parking brake lever
- This keeps the captain and first officer brake pedals in the applied position.

To release the parking brakes, momentarily push on the brake pedals. This moves the pawl stop down and the return spring turns the latch pawl. When you release the pedals, the pedals move to the brakes off position.

PARKING BRAKE SYSTEM - LINKAGE



PARKING BRAKE SYSTEM - LINKAGE

PARKING BRAKE SYSTEM - PARKING BRAKE SHUTOFF VALVE

Purpose

The parking brake shutoff valve closes to prevent brake accumulator pressure leakage through the normal antiskid valve return.

Location

The parking brake shutoff valve is on the aft bulkhead of the main landing gear wheel well.

Physical Description

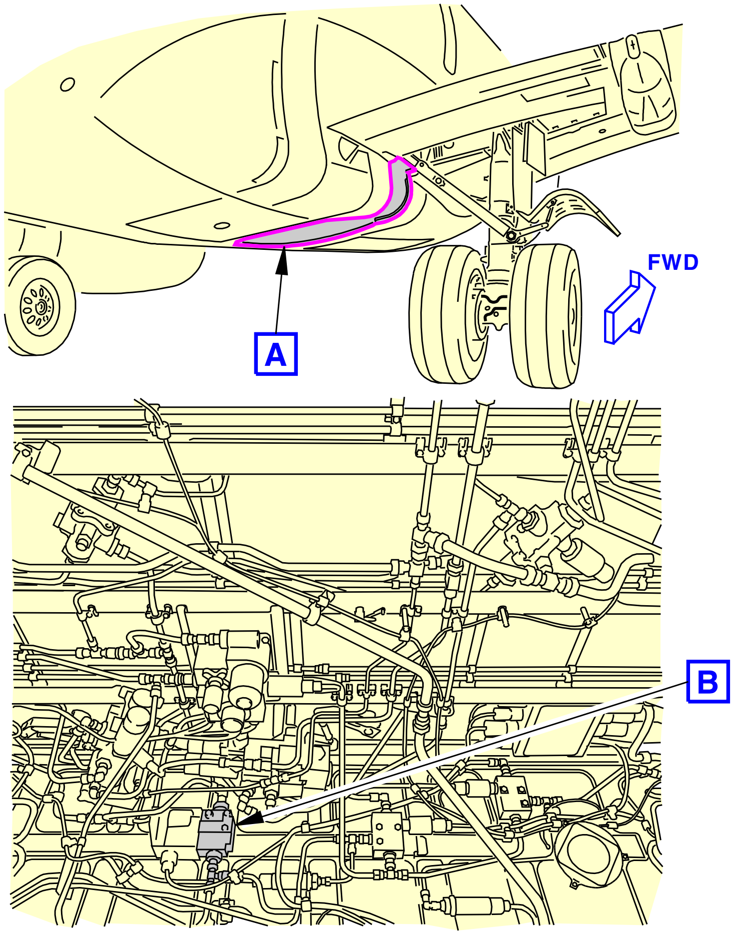
The valve is a 28v dc motor-operated valve. It has a manual override lever which shows the position of the valve and lets you move the valve manually. The nameplate on the motor shows the position of the manual override lever. The lever is in the open position when the lever is near the POSITION 1 or OPEN position on the nameplate. The lever is in the closed position when the lever is near the POSITION 2 or CLOSED position on the nameplate.

Functional Description

When the parking brake shutoff valve closes, it closes the return lines from the normal antiskid valves. This prevents brake system pressure loss caused by internal leakage in the normal antiskid valves.

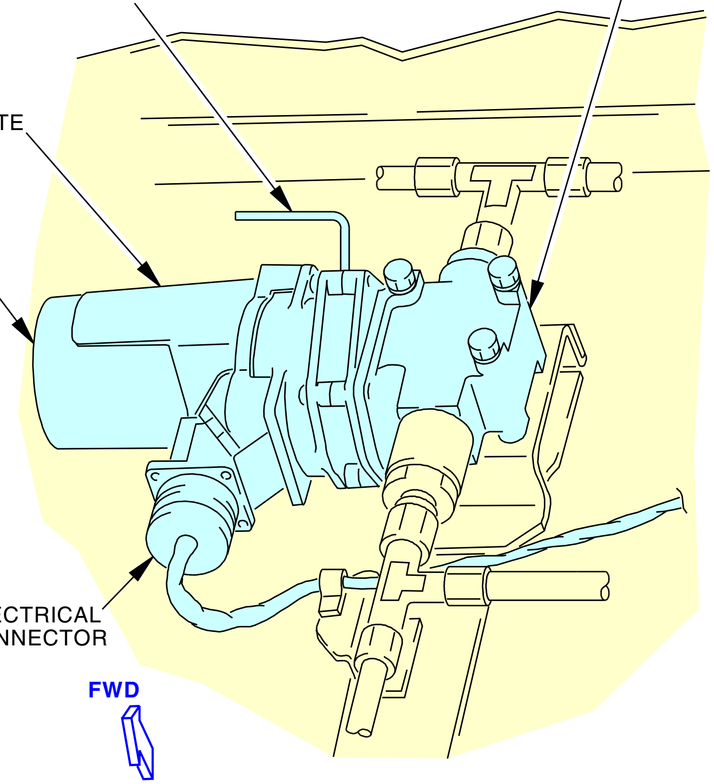
An internal position switch in the valve sends a valve position signal to the parking brake close sense relay.

PARKING BRAKE SYSTEM - PARKING BRAKE SHUTOFF VALVE



MAIN LANDING GEAR WHEEL WELL
(VIEW IN THE AFT DIRECTION)

A



PARKING BRAKE SHUTOFF VALVE

B

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PARKING BRAKE SYSTEM - PARKING BRAKE SHUTOFF VALVE

PARKING BRAKE SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL

General

When you set the parking brake lever, the parking brake switch sends 28v dc power from the hot battery bus to close the parking brake shutoff valve. Limit switches in the parking brake shutoff valve remove power from the valve motor when the valve reaches the commanded position. A position switch in the valve sends valve position signals to the parking brake light and the antiskid system.

Indication

When the parking brake shutoff valve moves from the open position, the position switch in the parking brake shutoff valve sends a ground to the parking brake light. This makes the parking brake light come on.

You can push-to-test the parking brake light.

When the parking brake switch moves to the set position, it sends 28v dc power to the parking brake repeater light on the external power panel. This makes the parking brake repeater light come on.

The parking brake switch sends lever set and lever not set signals to the proximity switch electronics unit (PSEU). The PSEU operates the takeoff warning system when the parking brake is set during a takeoff. The PSEU sends a parking brake set and airplane on ground signal to other airplane systems.

See the takeoff warning system section for more information about the aural warning system. (SECTION 31-53)

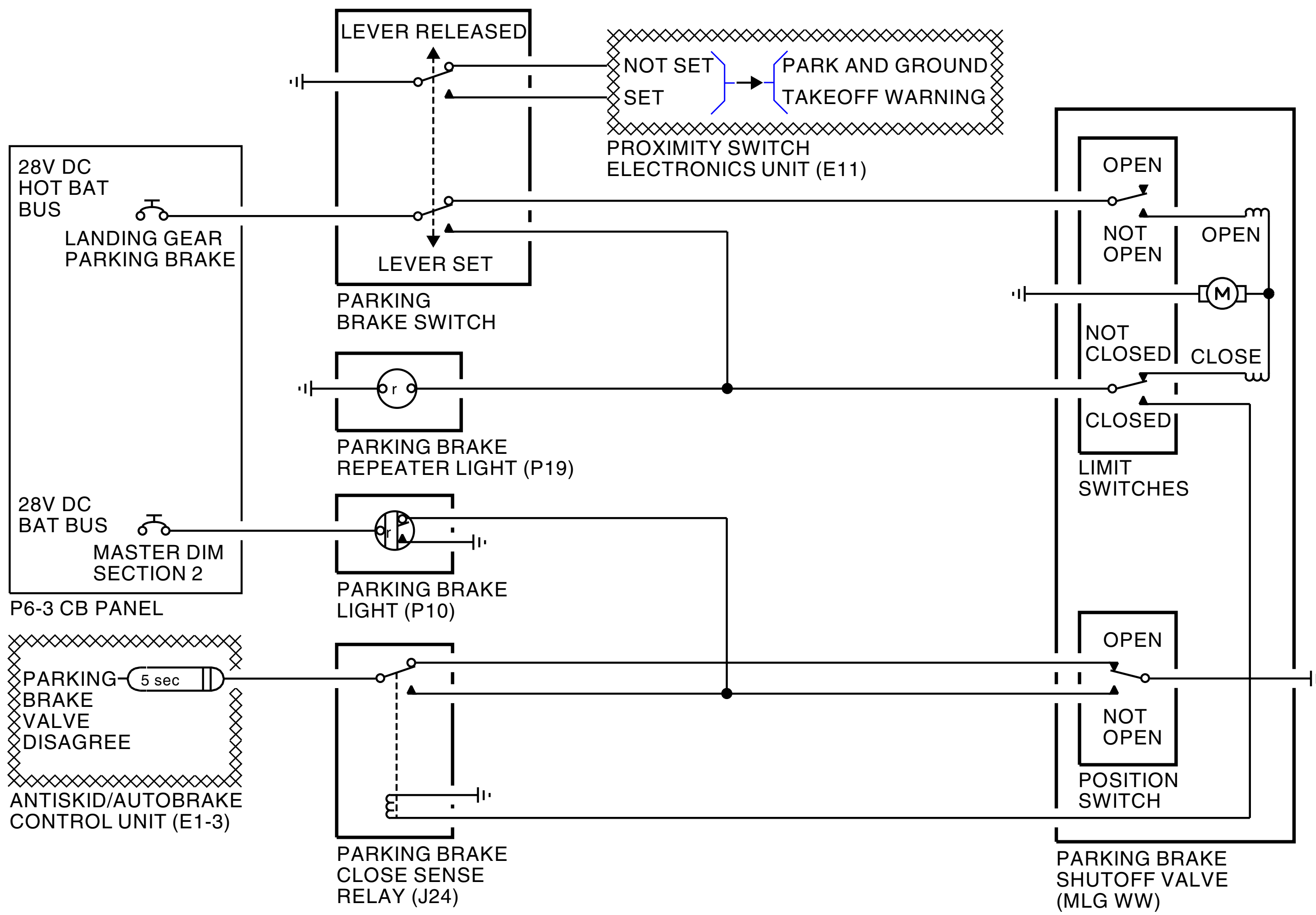
See the air/ground system section for more information about the PSEU. (SECTION 32-09)

Fault Monitoring

When the valve moves to the closed position, a limit switch inside the valve sends 28v dc from the parking brake switch to energize the parking brake close sense relay. A valve position signal goes through the parking brake close sense relay to the antiskid/autobrake control unit (AACU). The AACU monitors the parking brake shutoff valve for failure.

See the antiskid/autobrake system section for more information about the AACU. (SECTION 32-42)

PARKING BRAKE SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL



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PARKING BRAKE SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL

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TIRES AND WHEELS - GENERAL DESCRIPTION

Main Landing Gear

Each main landing gear has two tire and wheel assemblies.

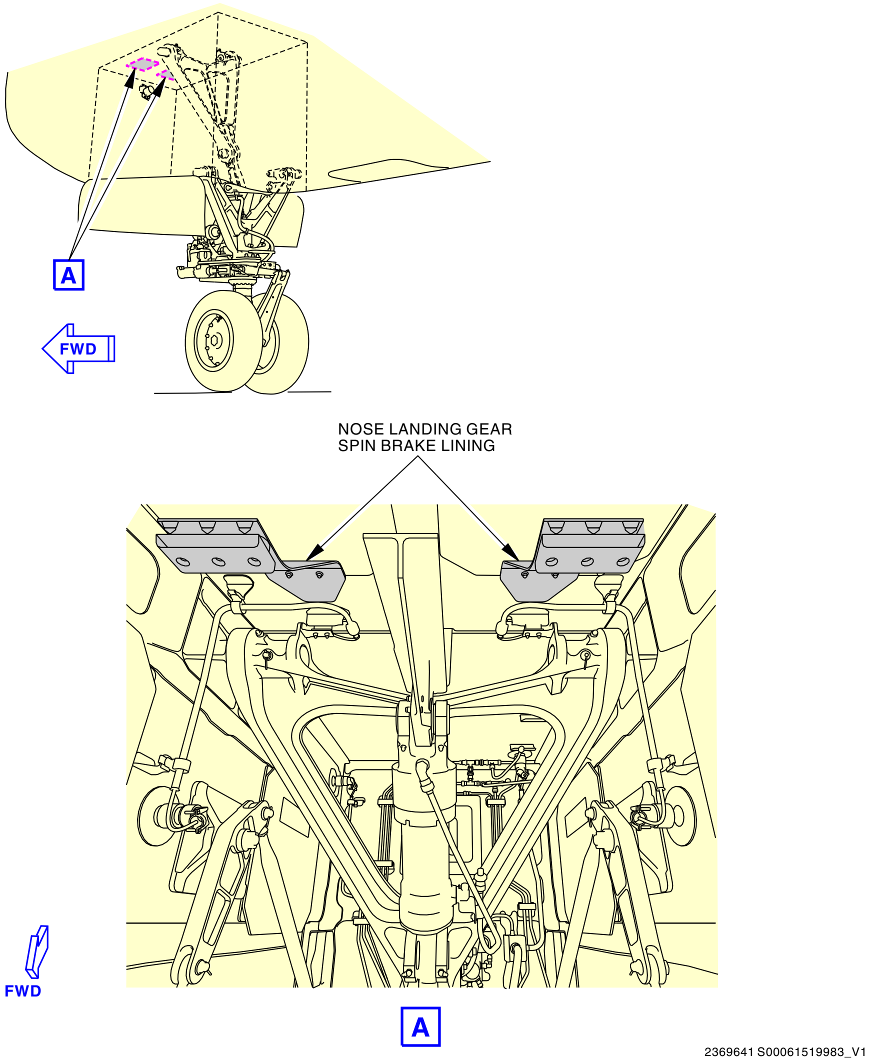
Nose Landing Gear

The nose landing gear has two tire and wheel assemblies.

Nose Wheel Spin Brake

Nose wheel spin brakes stop nose wheel rotation during retraction when the nose wheels enter the wheel well.

TIRES AND WHEELS - GENERAL DESCRIPTION



TIRES AND WHEELS - GENERAL DESCRIPTION

TIRES AND WHEELS - MAIN LANDING GEAR WHEEL AND TIRE

Main Landing Gear Wheels

The main landing gear wheels are made of inner and outer wheel halves. Tie bolts hold the two halves together. Brake rotor drive keys and heat shields are in the inner half of each wheel.

Each wheel has these components:

- Tire inflation valve
- Over pressure relief valve
- Thermal fuse plugs.

Tire Inflation Valve

A tire inflation valve is in the inner wheel half.

Over Pressure Relief Valve

An over pressure relief valve is in the inner wheel half. The relief valve releases all of the pressure in the tire when the pressure increases more than 375-450 psi. The over pressure relief valve must be replaced if it releases pressure.

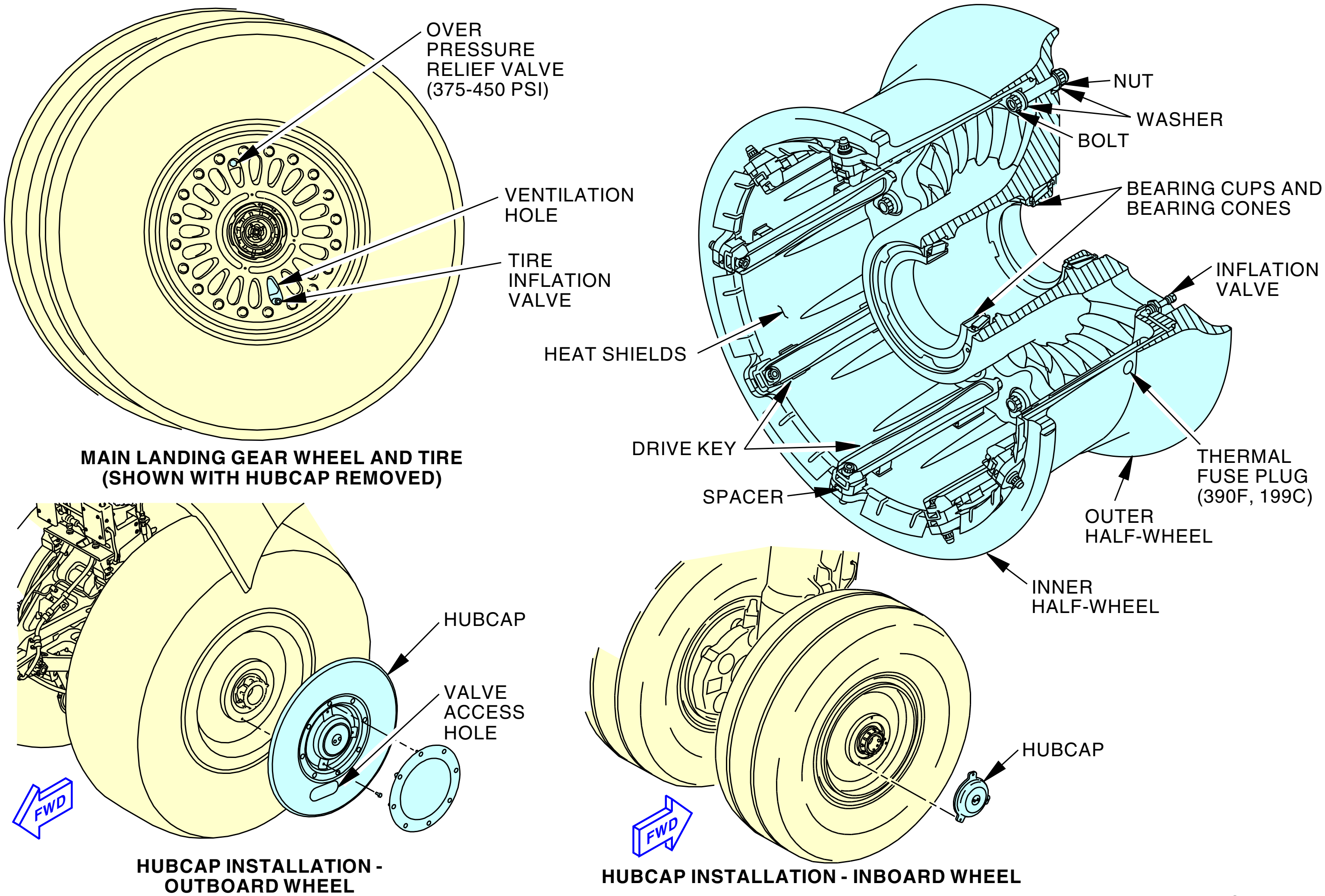
Thermal Fuse Plugs

Thermal fuse plugs in the inner wheel half prevent tire explosion caused by hot brakes. The plugs melt to release tire pressure at approximately 390F (199C). The fuse plug must be replaced if it melts.

Main Landing Gear Tires

Main landing gear tires are H44.5 x 16.5R21/30PR (737-7,-8) or H44.5 x 16.5R21/32PR (737-9 and 737-10).

TIRES AND WHEELS - MAIN LANDING GEAR WHEEL AND TIRE



2369646 S00061519989_V2

TIRES AND WHEELS - MAIN LANDING GEAR WHEEL AND TIRE

TIRES AND WHEELS - NOSE LANDING GEAR WHEEL AND TIRE

Nose Landing Gear Wheels

The nose landing gear wheels are made of inner and outer wheel halves. Tie bolts hold the two halves together.

Each wheel has these components:

- Tire inflation valve
- Over pressure relief valve.

Tire Inflation Valve

A tire inflation valve is in the outer wheel half.

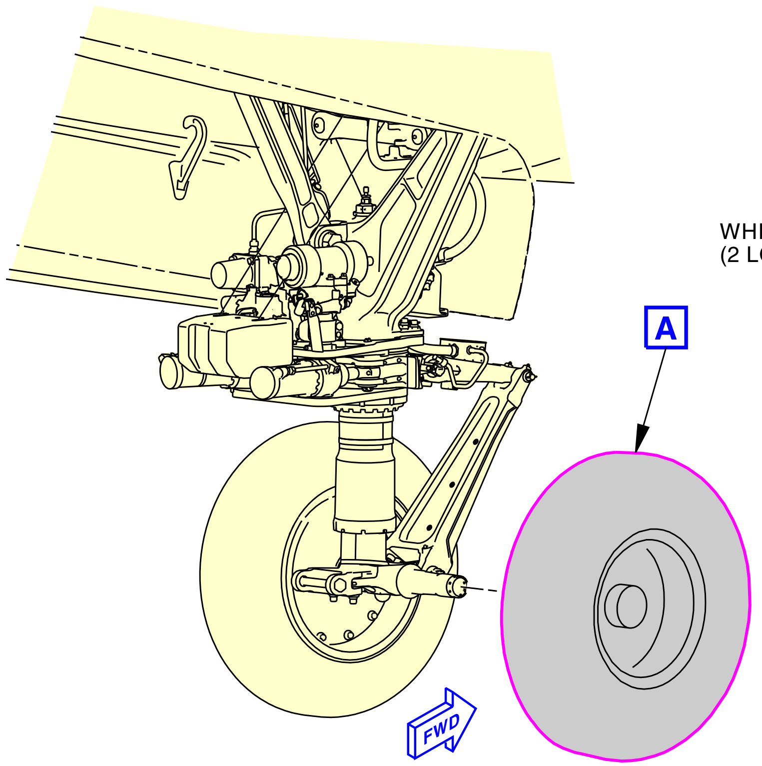
Over Pressure Relief Valve

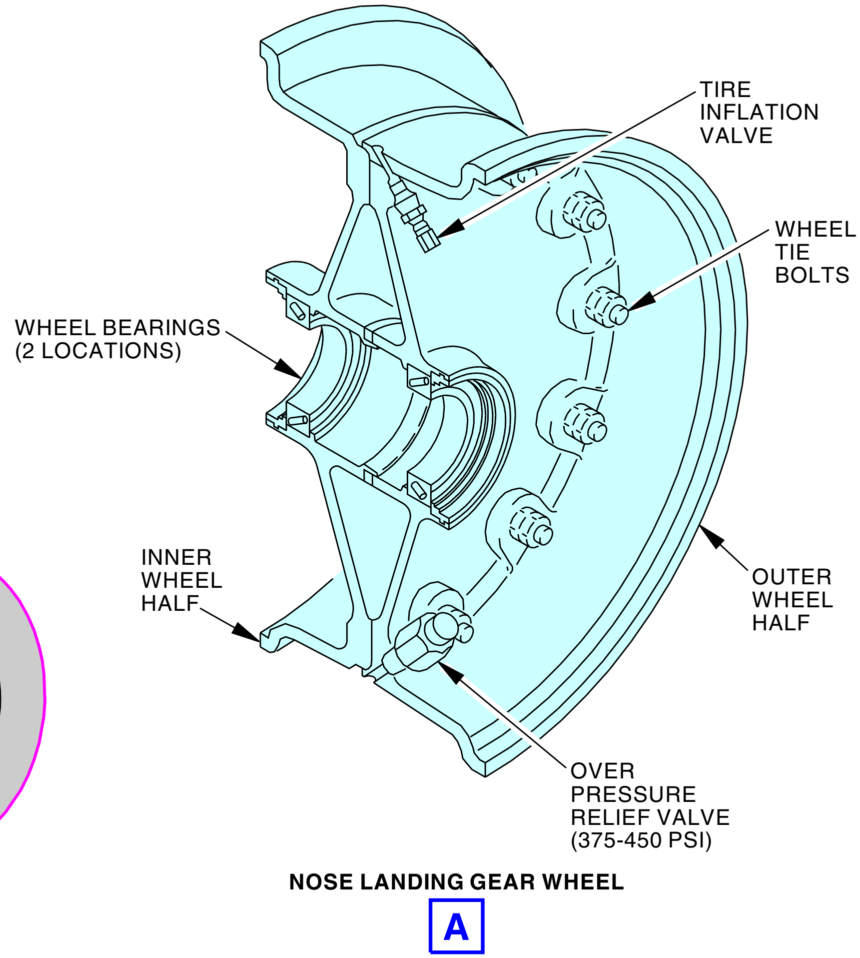
An over pressure relief valve is in the outer wheel half. The relief valve releases all of the pressure in the tire when the pressure is more than 375-450 psi. The over pressure relief valve must be replaced if it releases pressure.

Nose Landing Gear Tires

Nose landing gear tires are 27 x 7.75R15/12 PR.

TIRES AND WHEELS - NOSE LANDING GEAR WHEEL AND TIRE





2369648 S00061519992_V1

TIRES AND WHEELS - NOSE LANDING GEAR WHEEL AND TIRE

TIRES AND WHEELS - NOSE LANDING GEAR WHEEL SPIN BRAKE

Purpose

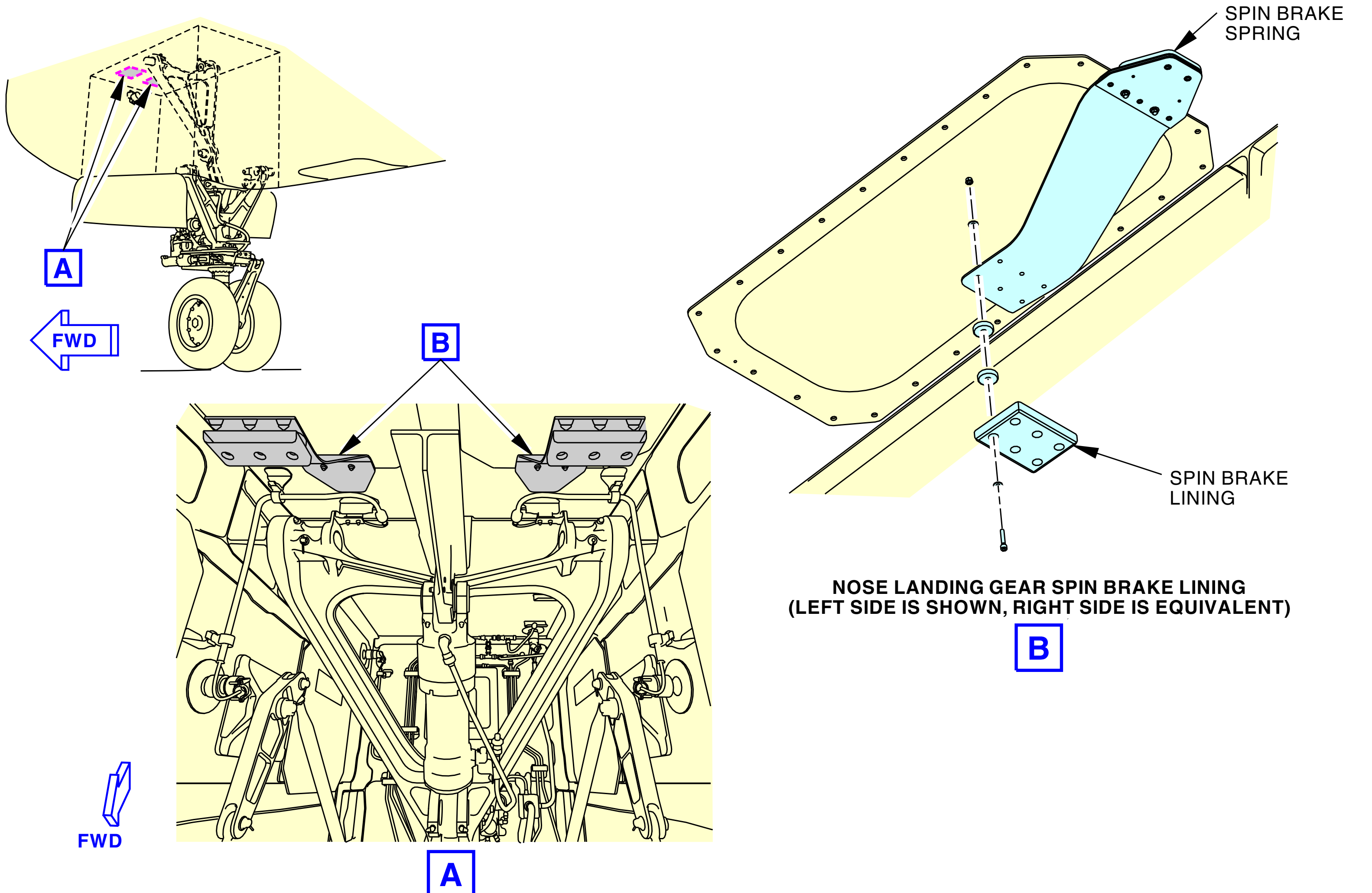
Two nose wheel spin brakes use friction with the nose tires to stop nose wheel rotation after the nose landing gear retracts into the wheel well.

Physical Description

The nose wheel spin brake assemblies attach to spring supports in the upper forward nose landing gear wheel well.

You can replace the wear pads on each assembly. The wear pads do not have asbestos in the pads.

TIRES AND WHEELS - NOSE LANDING GEAR WHEEL SPIN BRAKE



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TIRES AND WHEELS - NOSE LANDING GEAR WHEEL SPIN BRAKE

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TIRE AND BRAKE MONITORING SYSTEM - BRAKE TEMPERATURE FUNCTION

Brake Temperature Function

The brake temperature monitoring system (BTMS) measures the temperatures of each MLG brake and displays them on the MDS system page. A scaled temperature is displayed adjacent to each tire/brake symbol with values ranging from 0.0 to 9.9. A 0.0 reading corresponds with a cold brake. The tire/wheel symbol also have a corresponding brake symbol. Brake temperatures are displayed in white unless a brake overheat condition exists in which case the displayed temperature for the associated brake will turn amber and the BRAKE TEMP crew alert light on the flight deck will be illuminated. The overheat indication will turn off after all the overheat brakes have cooled to a temperature below 3.5.

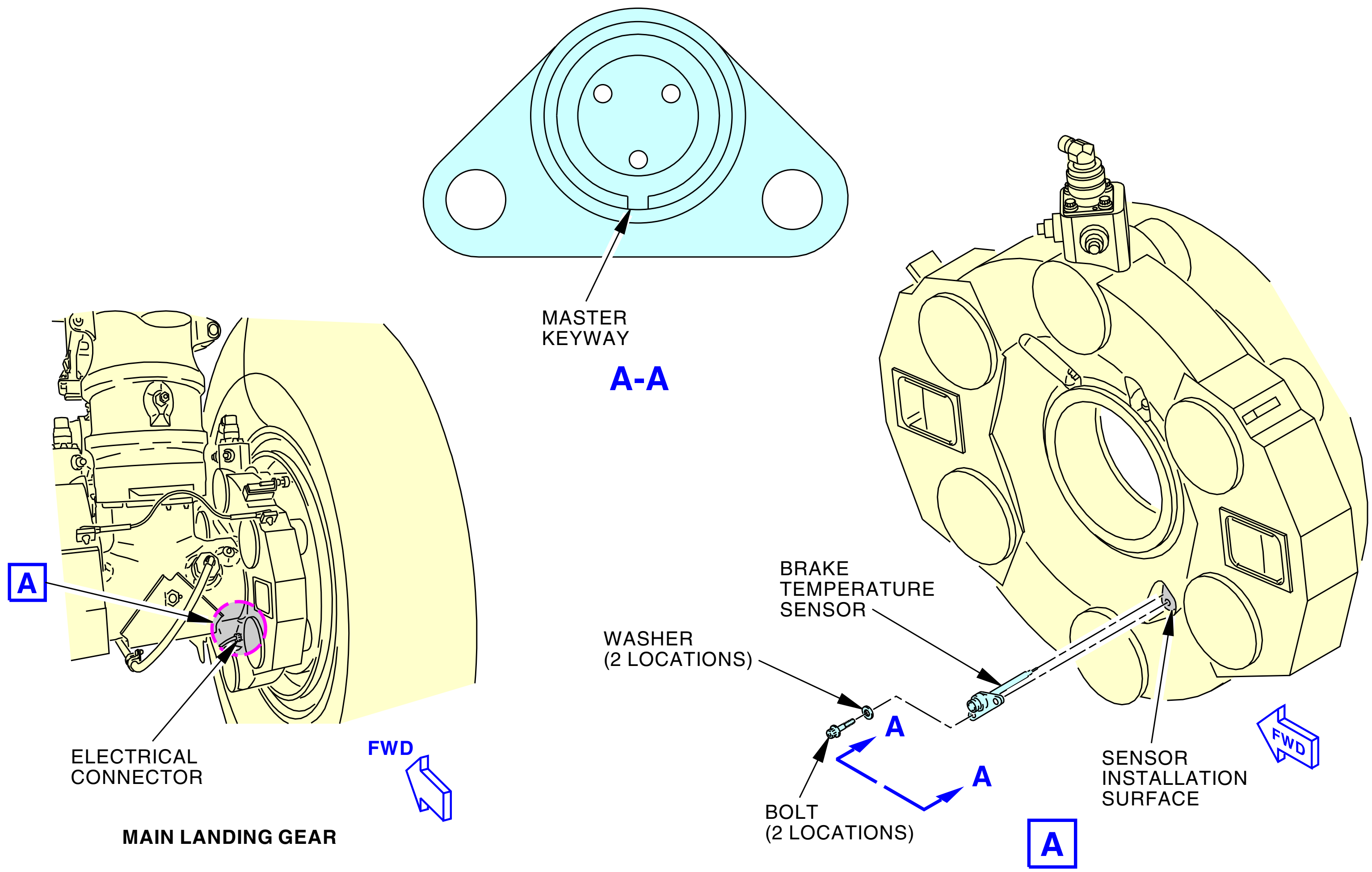
The brake icon display will change according to brake temperatures on each brake independent of the other brakes as follows:

- If the brake temperature is <2.5, the icon is not filled.

- If the brake temperature is ≥2.5 and a brake overheat conditions does not exist for that brake, the brake icon will be solid, indicating a warm brake.

- If a brake overheat condition exists, the brake icon will turn amber.

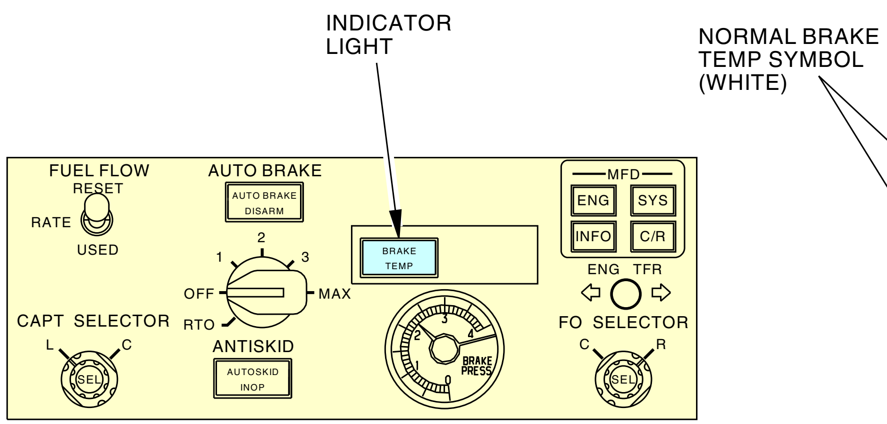
TIRE AND BRAKE MONITORING SYSTEM - BRAKE TEMPERATURE FUNCTION



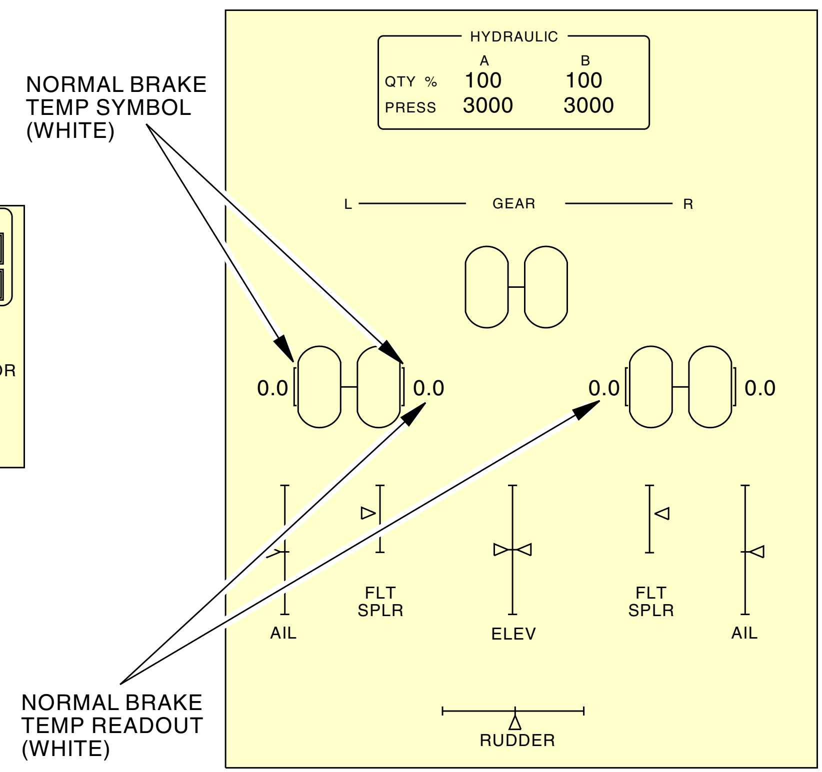
2571813 S0000589451_V1

BRAKE TEMPERATURE FUNCTION

TIRE AND BRAKE MONITORING SYSTEM - BRAKE TEMPERATURE FUNCTION



MULTI-FUNCTION PANEL
(EXAMPLE)

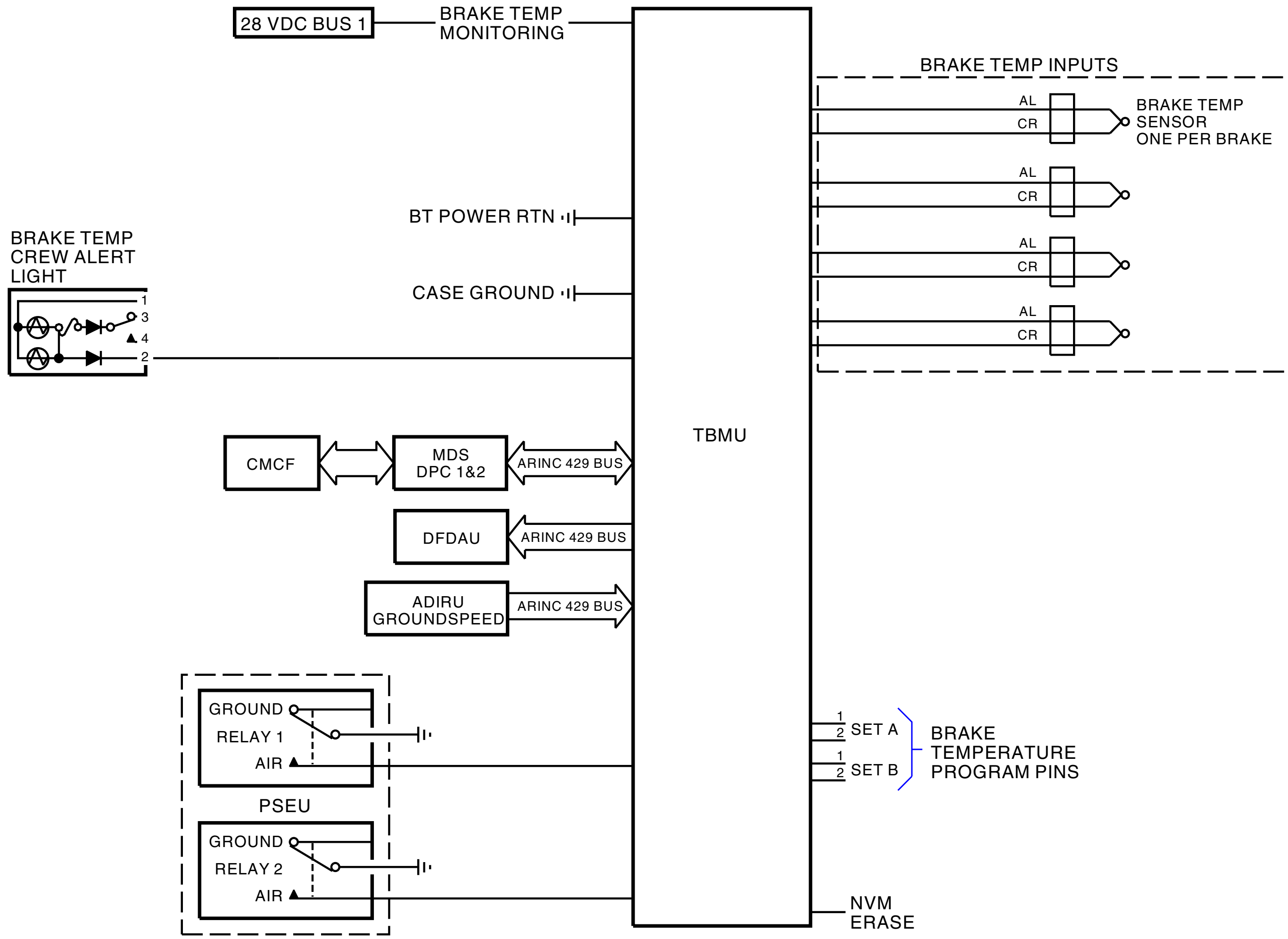


MAX DISPLAY SYSTEM
(LANDING GEAR SYNOPTIC PAGE)
(EXAMPLE)

2942288 S0000718847_V1

BRAKE TEMPERATURE FUNCTION

TIRE AND BRAKE MONITORING SYSTEM - BRAKE TEMPERATURE FUNCTION



BRAKE TEMPERATURE FUNCTION

TIRE AND BRAKE MONITORING SYSTEM - TIRE AND BRAKE MONITORING UNIT

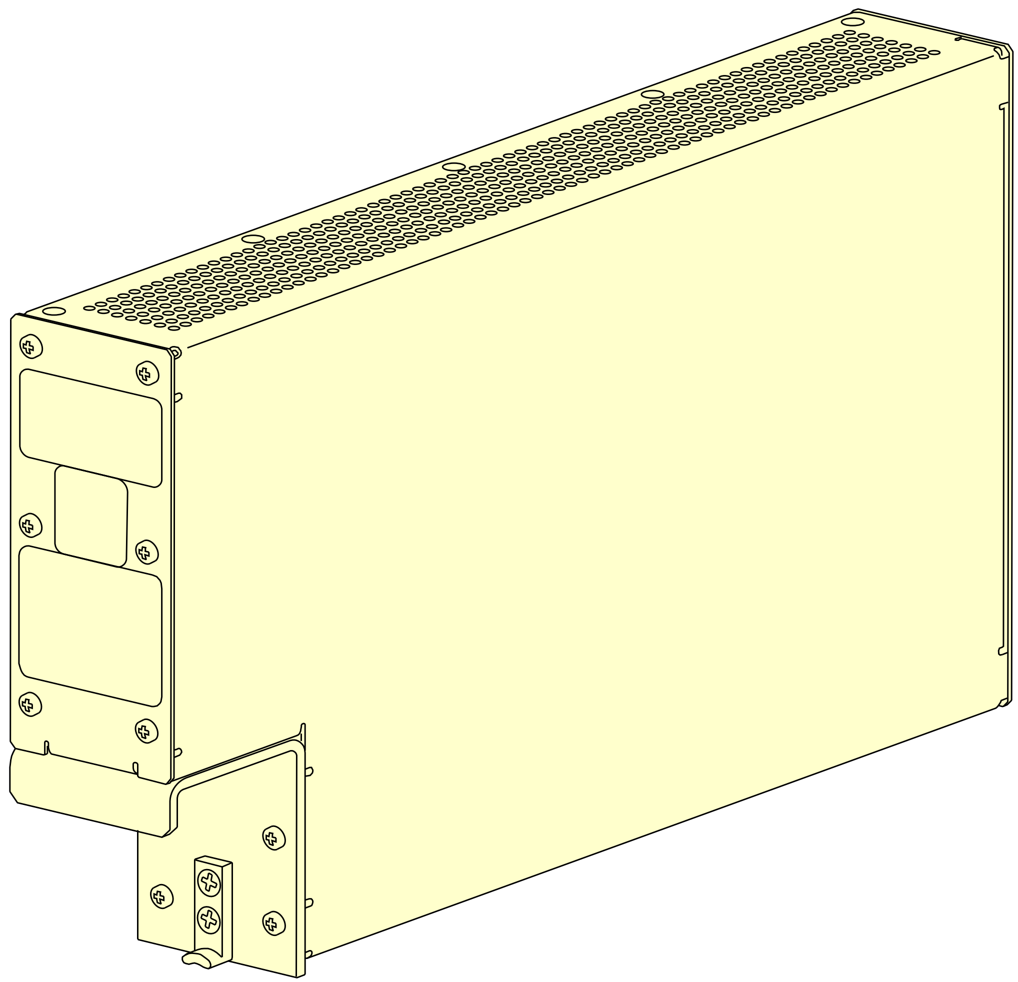
Purpose

The Tire and Brake Monitoring Unit (TBMU) monitors brake temperature by multiple sensors. The sensors monitor the brake temperature on all four main gear wheels of the aircraft.

TBMU Operation

The TBMU converts brake temperature data into digital A429 data, which is transmitted to the 737 MAX Display System (MDS) for display in the cockpit of the aircraft. The TBMU also communicates through A429 data with the Central Maintenance Computer (CMC) to report Line Replaceable Unit (LRU) failures for maintenance purposes. The TBMU also determines overheated brake conditions, which are indicated by two separate flight deck advisory lamps.

TIRE AND BRAKE MONITORING SYSTEM - TIRE AND BRAKE MONITORING UNIT



TIRE AND BREAK MONITORING UNIT

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TIRE AND BRAKE MONITORING SYSTEM - TIRE AND BRAKE MONITORING UNIT

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NOSE WHEEL STEERING SYSTEM - GENERAL DESCRIPTION

Purpose

The nose wheel steering system supplies the ground directional control of the airplane.

General Description

Steering inputs are from the steering wheels or the rudder pedals. When you move the captain or first officer steering wheel full travel, the nose wheels turn a maximum of 78 degrees in the left or right direction. When you move the rudder pedals full travel on the ground, the nose wheels turn a maximum of 7 degrees in the left or right direction. Steering inputs from the steering wheels or rudder pedals go to the metering valve through a cable loop.

CAUTION	DO NOT OPERATE THE STEERING WHEEL WITH THE SHOCK STRUT FULLY EXTENDED AND THE TORSION LINKS CONNECTED. DAMAGE TO THE CENTERING CAMS OF THE SHOCK STRUT CAN OCCUR. IF IT IS NECESSARY TO OPERATE THE STEERING SYSTEM, MAKE SURE THAT YOU COMPRESS THE SHOCK STRUT TO 2.10 INCHES OR MORE. MAKE SURE THAT THE DISTANCE BETWEEN THE BOTTOM SURFACE OF THE LOWER STEERING PLATE AND THE TOP SURFACE OF THE TOWING LUG IS LESS THAN 21.90 INCHES.

Hydraulic system A usually supplies pressure to extend and retract the main landing gear. The extend pressure from the landing gear extension and retraction system supplies pressure for nose wheel steering.

The landing gear transfer valve changes the pressure supply of nose wheel steering from hydraulic system A to hydraulic system B. You manually control the landing gear transfer valve with the alternate nose wheel steering switch in the flight compartment.

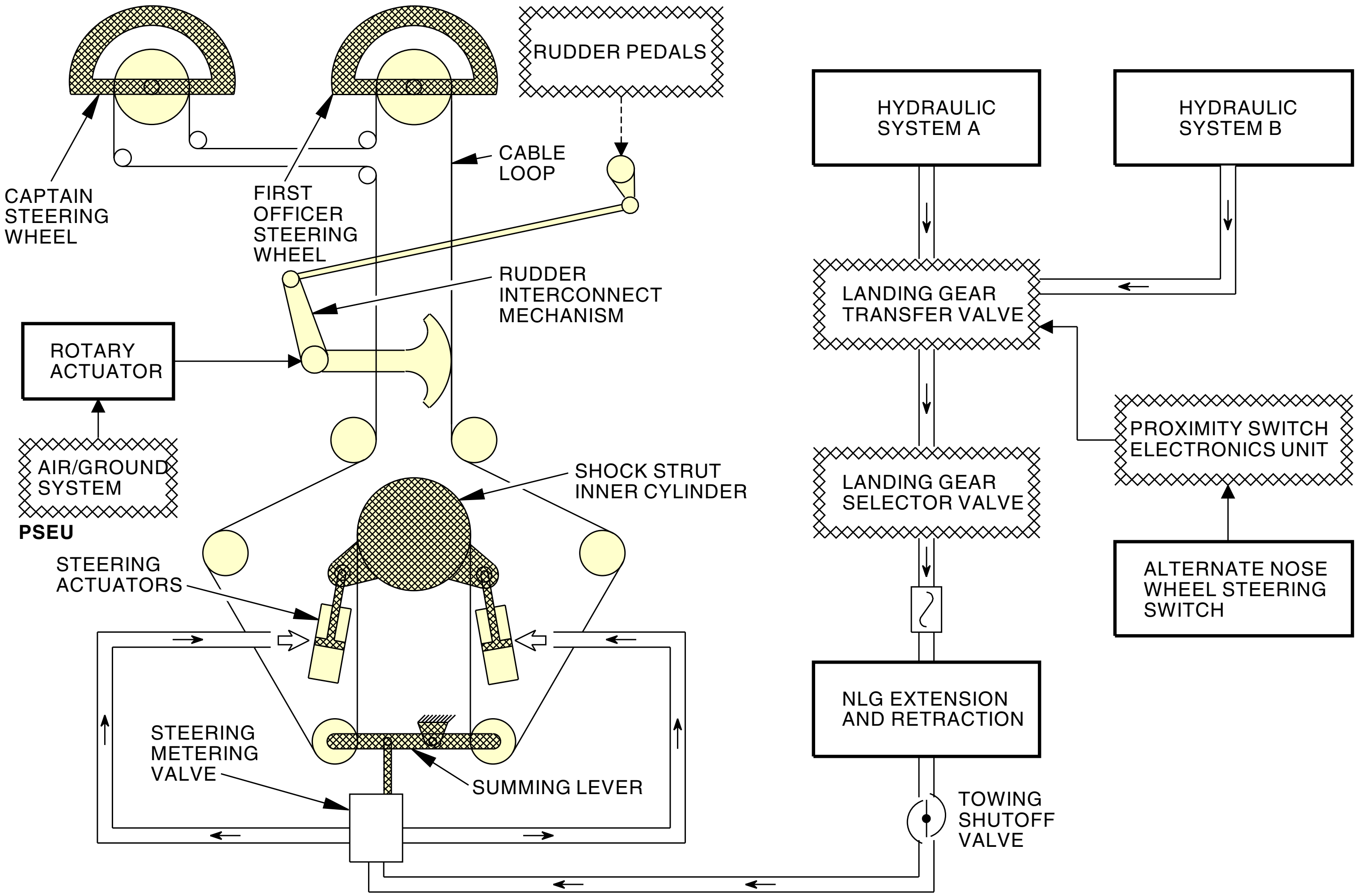
These conditions cause the manual operation of the landing gear transfer valve:

- Alternate nose wheel steering switch to the alternate position
- Normal quantity in system B reservoir
- Nose air/ground system in ground mode.

The steering metering valve supplies right turn or left turn pressure to the steering actuators.

The rotary actuator disconnects the rudder pedal input in the air.

NOSE WHEEL STEERING SYSTEM - GENERAL DESCRIPTION



2549619 S0000607216_V1

NOSE WHEEL STEERING SYSTEM - GENERAL DESCRIPTION

NOSE WHEEL STEERING SYSTEM - COMPONENT LOCATION

General

The components of the nose wheel steering system are in the flight compartment and the nose landing gear wheel well.

Flight Compartment Components

These are the nose wheel steering components in the flight compartment:

- Alternate nose wheel steering switch
- Steering wheel (2)
- Control cables
- Rudder Pedals

Nose Landing Gear Wheel Well Components

These are the nose wheel steering components in the nose landing gear wheel well:

- Control cables
- Rudder pedal steering mechanism
- Rudder pedal steering rotary actuator
- Summing mechanism
- Steering metering valve module
- Steering actuators (2)
- Nose wheel steering collar
- Towing shutoff valve

Location

The alternate nose wheel steering switch is on the captain forward instrument panel.

The steering wheels are on the sidewall panel below the captain and first officer number 2 window.

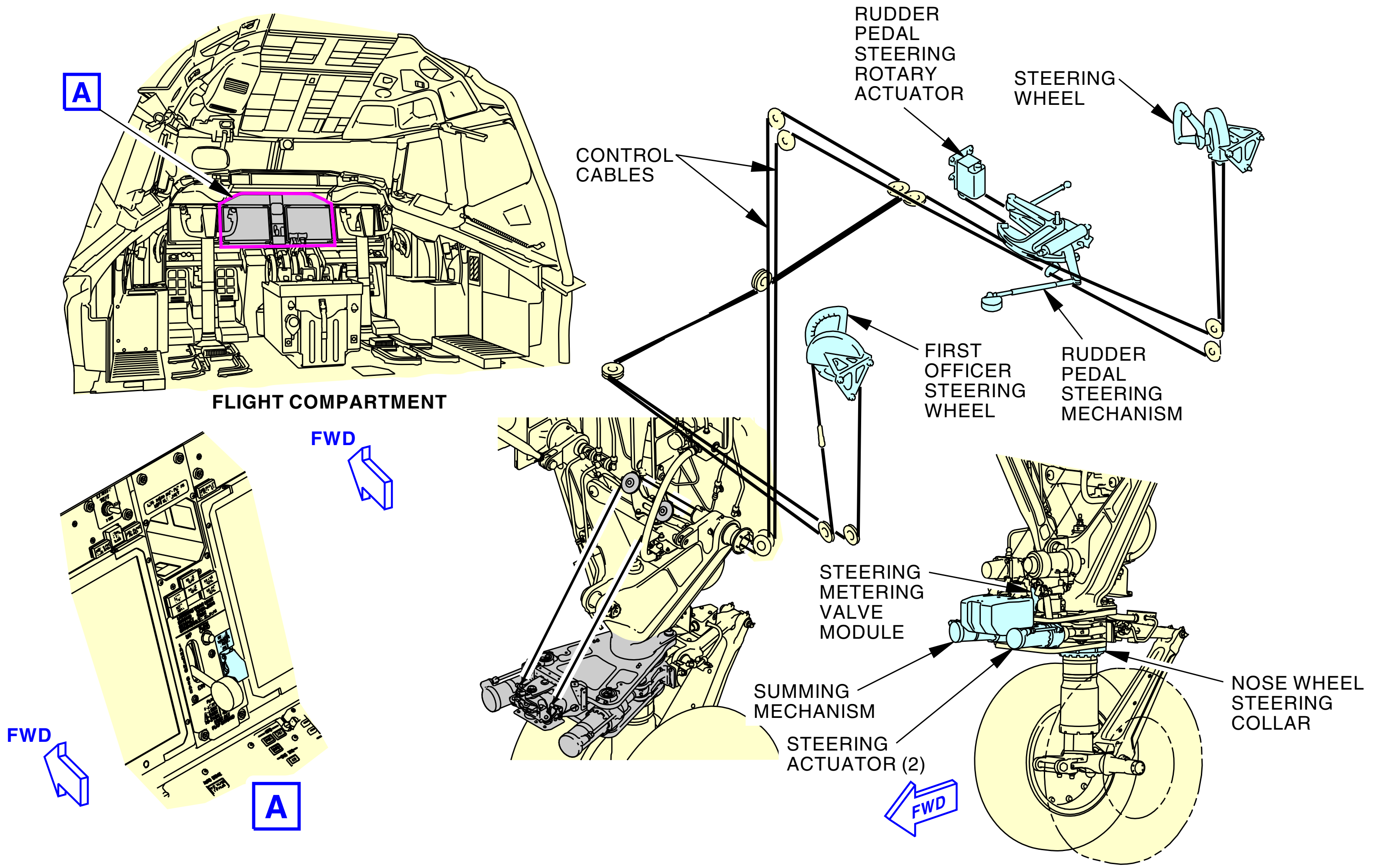
The rudder pedal steering mechanism and rotary actuator are below the flight compartment floor on the left side. You get access to them through a removable panel in the left side of the nose landing gear wheel well.

The control cables go from the steering wheels, through the rudder pedal steering mechanism, and down to the summing mechanism on the nose landing gear.

These are the components on the nose landing gear:

- Summing mechanism
- Steering metering valve module
- Steering actuators
- Nose wheel steering collar.

NOSE WHEEL STEERING SYSTEM - COMPONENT LOCATION



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NOSE WHEEL STEERING SYSTEM - COMPONENT LOCATION

NOSE WHEEL STEERING SYSTEM - RUDDER PEDAL STEERING MECHANISM AND ROTARY ACTUATOR

Purpose

The rudder pedal steering mechanism does these functions:

- Mixes the steering inputs from the rudder pedals and the steering wheel
- Prevents rudder pedal inputs when the airplane goes in the air
- Supplies centering forces.

The rotary actuator engages the rudder pedal steering when the nose gear is on the ground and disengages it in the air.

Location

The rudder pedal steering mechanism is below the flight compartment floor. You get access to the mechanism through the access panel on the left side bulkhead of the nose landing gear wheel well.

The rotary actuator is below the flight compartment floor, aft of the rudder pedal steering mechanism. You get access to the actuator through the access panel on the left side bulkhead of the nose landing gear wheel well.

Physical Description

The rudder pedal steering mechanism is controlled by the rudder pedal rotary actuator and has these components:

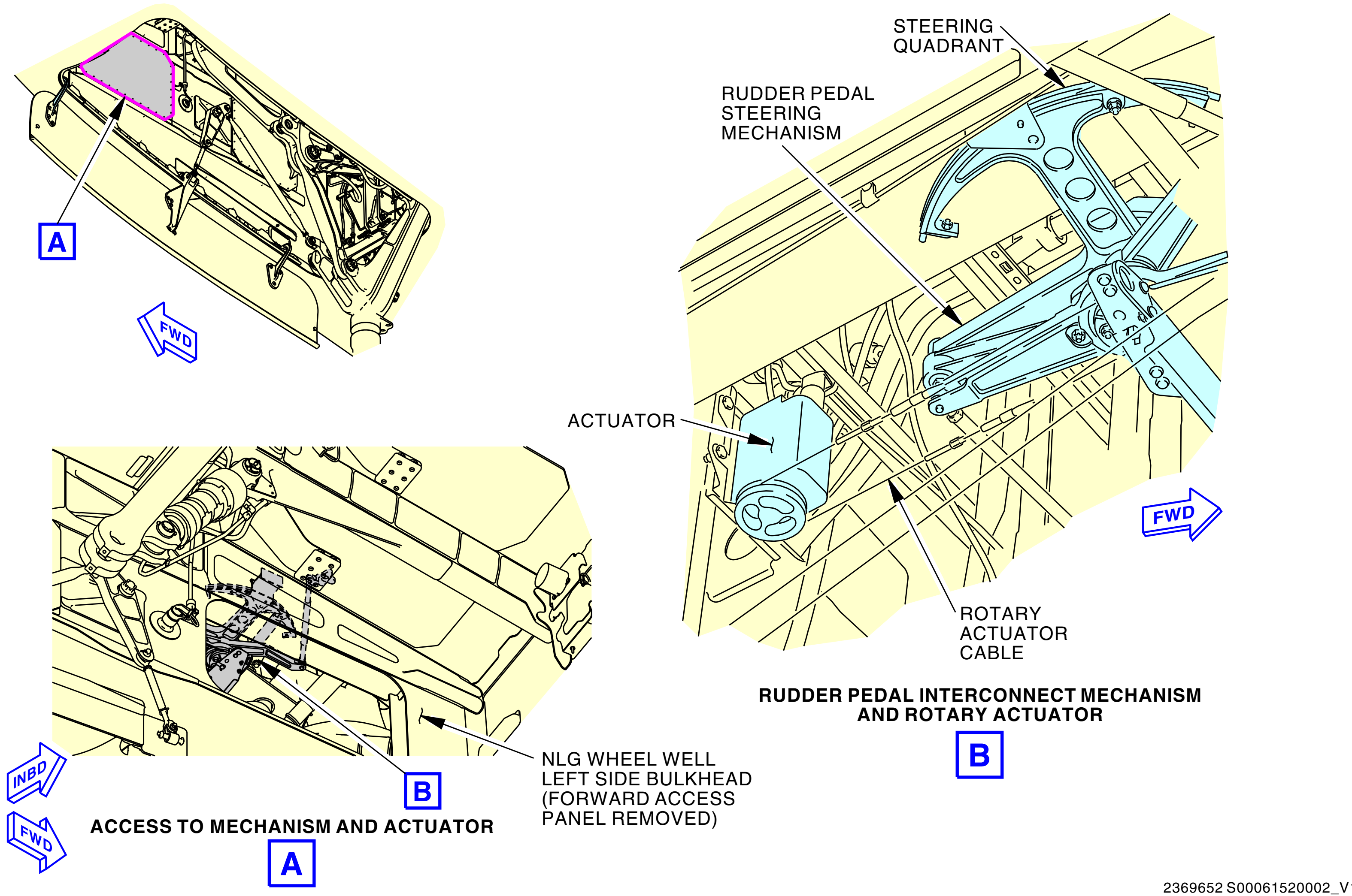
- Steering crank
- Rudder pedal steering quadrant
- Clutch arm
- Clutch crank stop
- Centering spring
- Eccentric drum.

The rudder pedal steering rotary actuator is a two-position electrical actuator that uses 115v ac power from bus 2. The actuator has a control drum connected to the bottom and a cable that is a connected to rudder pedal steering mechanism.

Functional Description

The rudder pedal steering rotary actuator moves a eccentric cam in the rudder pedal steering mechanism when the airplane goes in the air. This will not let the rudder pedal inputs move the nose wheel steering control cables.

NOSE WHEEL STEERING SYSTEM - RUDDER PEDAL STEERING MECHANISM AND ROTARY ACTUATOR



NOSE WHEEL STEERING SYSTEM - RUDDER PEDAL STEERING MECHANISM AND ROTARY ACTUATOR

NOSE WHEEL STEERING SYSTEM - RUDDER PEDAL STEERING MECHANISM - FUNCTIONAL DESCRIPTION

General

The nose wheel steering rudder pedal steering mechanism Mixes the rudder pedal and steering wheel inputs to the nose wheel steering metering valve.

Components

The rudder pedal steering mechanism has these parts:

- Steering crank
- Rudder pedal steering quadrant
- Clutch arm
- Clutch crank stop
- Centering spring
- Eccentric drum.

Airplane In The Air

When the airplane goes into the air, a signal from the air/ground system sends power to the rotary actuator. The rotary actuator moves the eccentric drum to the air position. This moves the clutch arm away from the steering crank and will not let any movement of the rudder pedals move the clutch arm. Rudder pedal inputs do not move the steering quadrant.

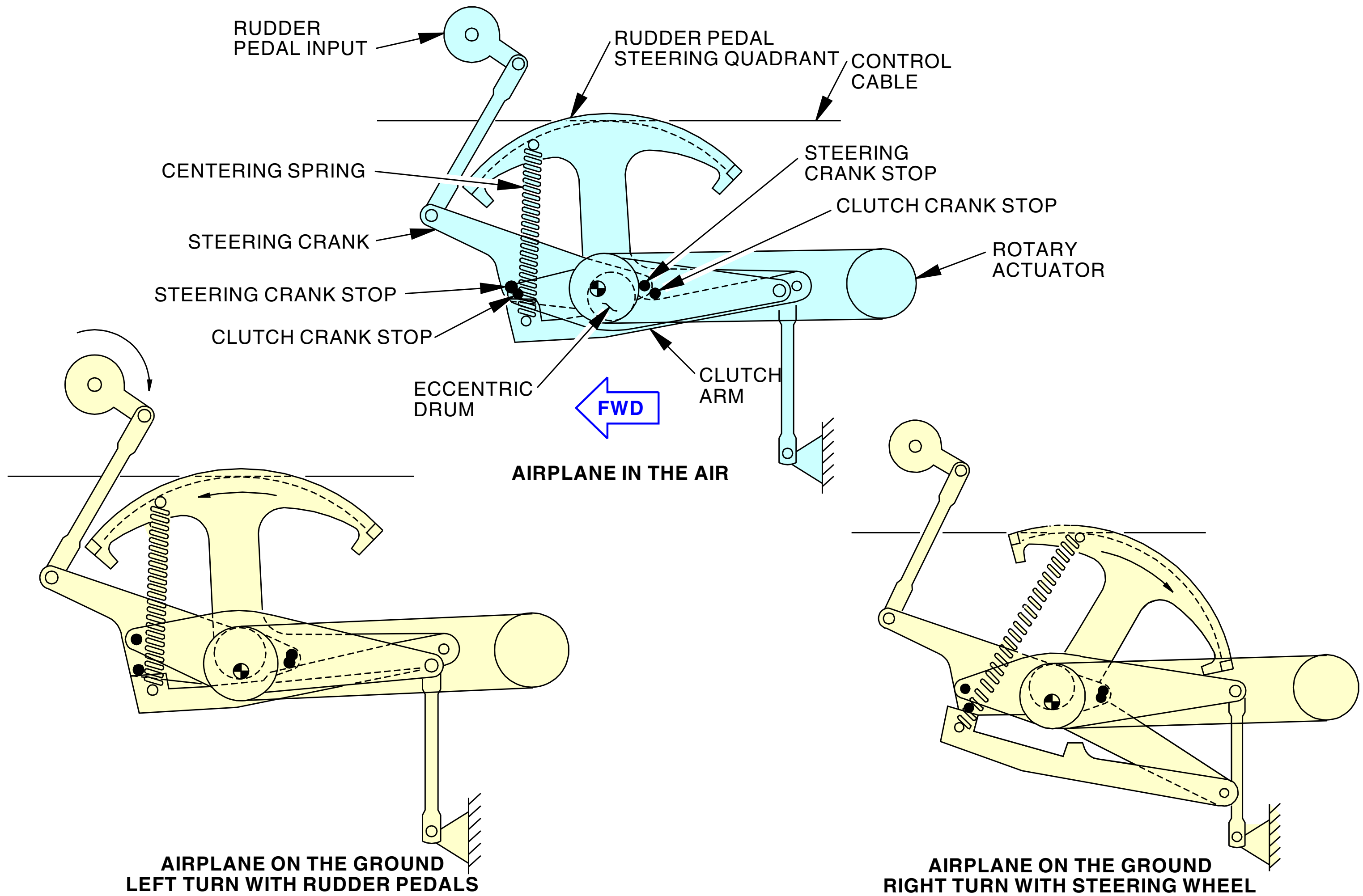
Airplane On The Ground

When the airplane is on the ground, a signal from the air/ground system sends power to the rotary actuator. The rotary actuator moves the eccentric drum to the ground position. This moves the clutch arm in contact with the steering crank stops and permits movement of the rudder pedals to move the clutch arm and then move the steering quadrant.

Movement of the steering wheel moves the control cable and steering quadrant. When the steering quadrant turns, the clutch arm contacts the steering crank stops and extends the centering spring. Because the centering spring in the rudder system is stronger than the centering spring in the pedal steering mechanism, the steering crank will not move. Movement of the steering wheel does not back drive the rudder pedals.

The steering wheel always overrides rudder pedal input because it goes directly to the metering valve through the control cables.

NOSE WHEEL STEERING SYSTEM - RUDDER PEDAL STEERING MECHANISM - FUNCTIONAL DESCRIPTION



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NOSE WHEEL STEERING SYSTEM - RUDDER PEDAL STEERING MECHANISM - FUNCTIONAL DESCRIPTION

NOSE WHEEL STEERING SYSTEM - SUMMING MECHANISM AND STEERING METERING VALVE MODULE

General

The nose wheel steering summing mechanism mixes steering wheel input and nose gear position feedback to control the nose wheel steering metering valve.

The steering metering valve module controls the flow of hydraulic pressure to the steering actuators.

Location

The summing mechanism is above the upper steering plate on the front of the nose landing gear. A protective cover (not shown) is on the summing mechanism.

The steering metering valve is on the upper steering plate on the front of the nose landing gear.

Physical Description

The summing mechanism has these components:

- Summing lever
- Pulley (2)
- Input rod.

The pulleys connect to each side of the summing lever. The control cable winds around each pulley.

The steering metering valve module has these components:

- Metering valve
- Dynamic load damper
- Bypass/relief valve (not shown)
- Compensator
- Towing shutoff valve and lever
- Swivel valve (2).

Summing Mechanism

The summing mechanism pivots about its center. The input rod connects the summing mechanism to the steering metering valve.

Steering Metering Valve Module

The metering valve controls hydraulic flow to the steering actuators.

The hydro-mechanical dynamic load damper decreases shimmy damping in the nose landing gear.

The compensator keeps backpressure in the steering metering valve. The backpressure supplies a force to dampen shimmy, and fluid for the actuators when the nose wheel steering system does not have hydraulic system pressure.

A towing lever on the steering metering valve module controls a towing shutoff valve.

The swivel valves control hydraulic flow to the two sides of the steering actuators.

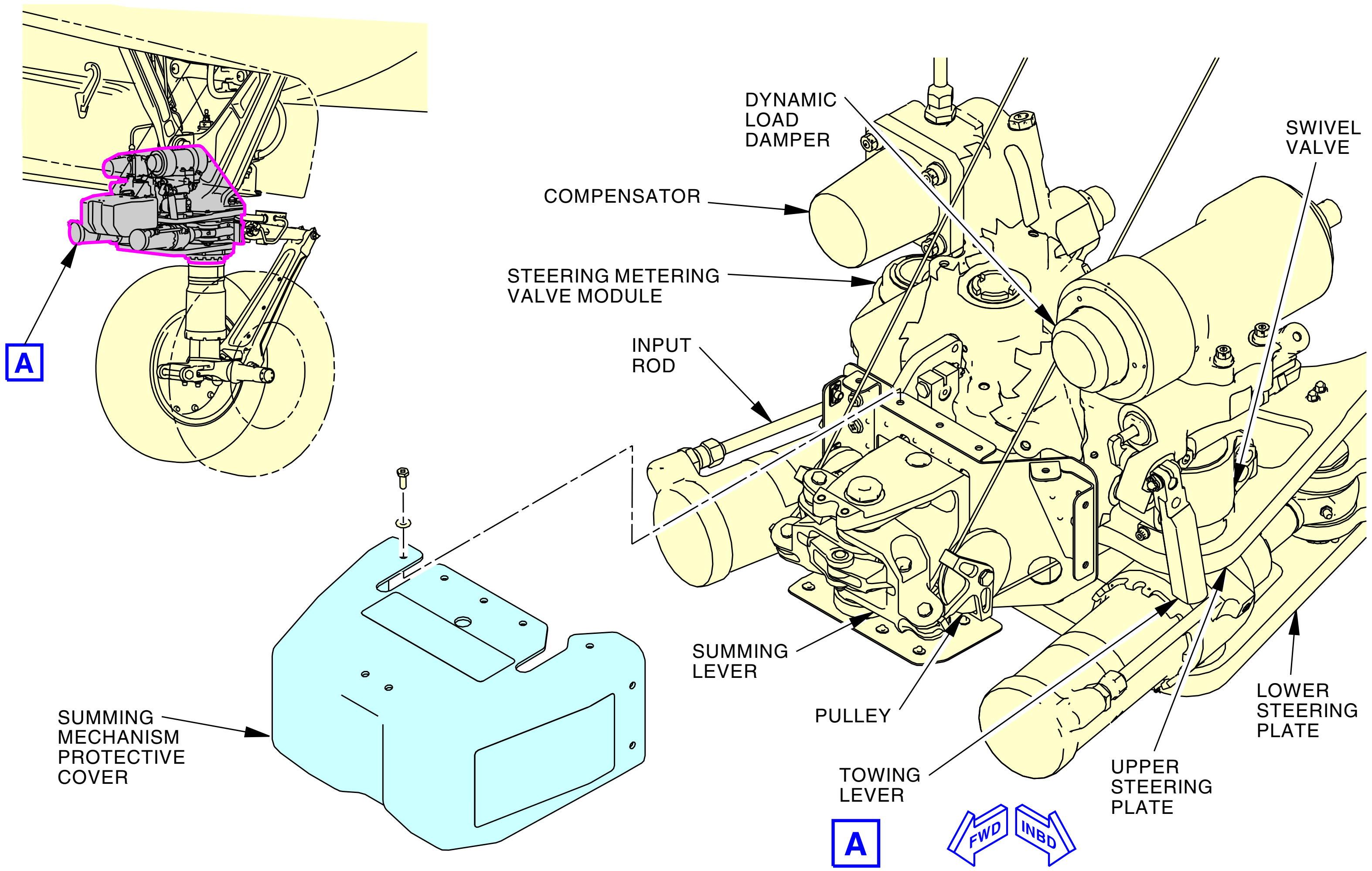
Functional Description

Steering wheel or rudder pedal input moves the summing mechanism from the neutral position. This makes an input to the steering metering valve module that sends pressure to the nose wheel steering actuators. The nose wheel steering actuators turn the nose landing gear wheels.

The movement of the nose gear wheels moves the summing mechanism back towards the neutral position. When the nose landing gear wheel position agrees with the steering wheel or rudder pedal position, the summing mechanism moves the metering valve to the neutral position. This stops the flow to the nose wheel steering actuators.

A towing lever lets you depressurize the nose wheel steering system. Because of this, you do not have to depressurize hydraulic system A to tow the airplane.

NOSE WHEEL STEERING SYSTEM - SUMMING MECHANISM AND STEERING METERING VALVE MODULE



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NOSE WHEEL STEERING SYSTEM - SUMMING MECHANISM AND STEERING METERING VALVE MODULE

NOSE WHEEL STEERING SYSTEM - STEERING ACTUATORS AND STEERING COLLAR

Purpose

The hydraulic steering actuators move the steering collar to turn the nose wheels.

The steering collar transmits steering torque through the upper and lower torque links to the inner cylinder of nose landing gear.

Location

The steering actuators are trunnion-mounted between the upper and lower steering plates. Each actuator is connected to a swivel valve at one end and the steering collar at the other end.

The steering collar is bearing-mounted around the nose gear shock strut outer cylinder. The torsion links connect the steering collar to the shock strut inner cylinder.

Physical Description

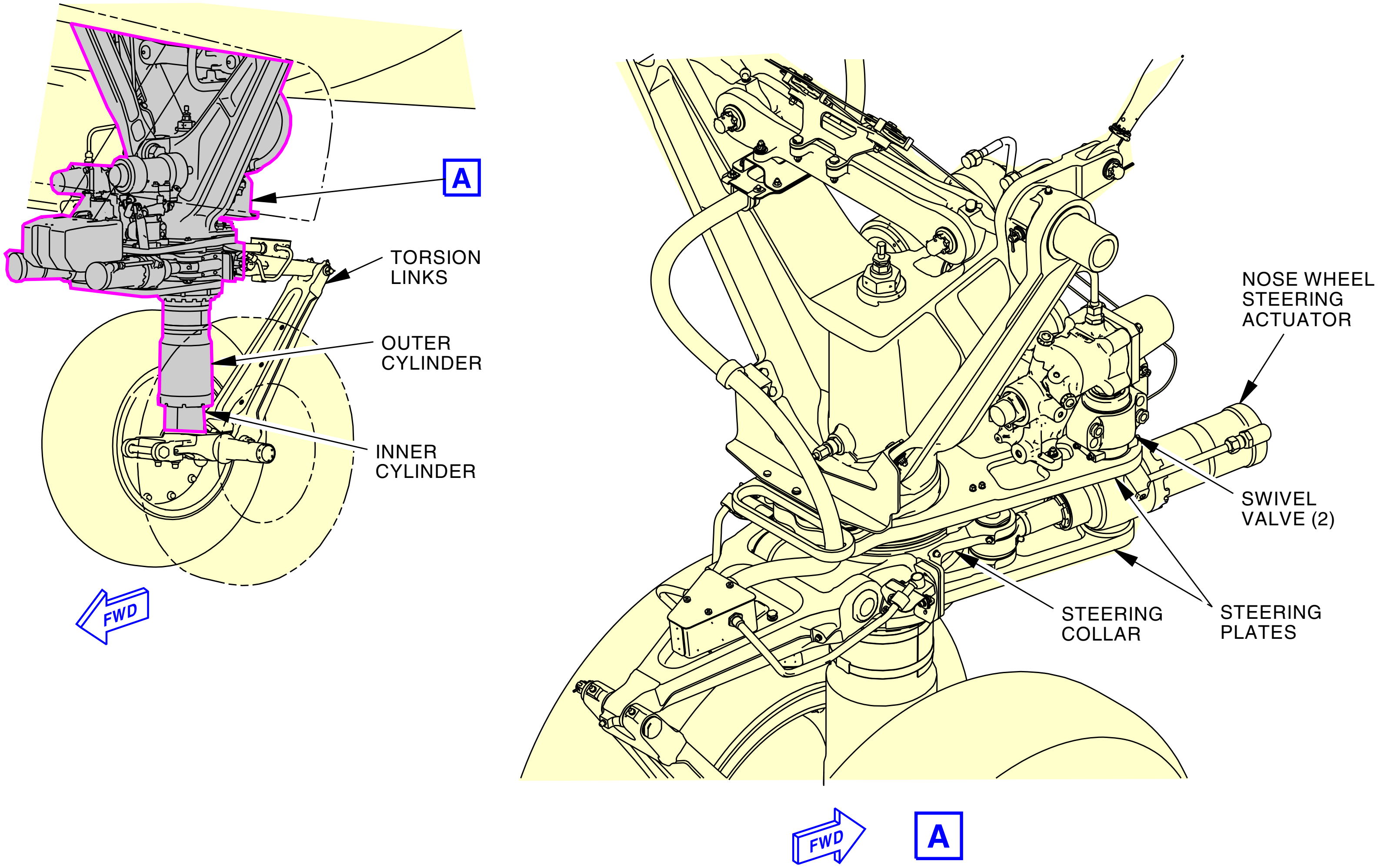
The steering actuators are unbalanced piston type actuators. Each actuator can swivel left or right. The rod ends of the actuators are connected to the steering collar.

Functional Description

The steering actuators get hydraulic pressure from the landing gear hydraulic system and supply steering forces to turn the steering collar.

The steering collar transmits the actuator steering forces, through the torsion links and shock strut inner cylinder, and to the nose landing gear wheels.

NOSE WHEEL STEERING SYSTEM - STEERING ACTUATORS AND STEERING COLLAR



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NOSE WHEEL STEERING SYSTEM - STEERING ACTUATORS AND STEERING COLLAR

NOSE WHEEL STEERING SYSTEM - FUNCTIONAL DESCRIPTION - HYDRAULIC

General

The nose wheel system uses landing gear down pressure to turn the nose landing gear wheels.

Steering inputs from the steering wheel or rudder pedals go though the control cables to the metering valve. This makes an input through the summing mechanism to move the steering metering valve. This lets hydraulic pressure go through the swivel valves to the steering actuators.

The actuators get pressure on the extend side, the retract side, or both sides to move the nose landing gear wheels from 0 - 78 degrees.

Gear Movement: 0 - 23 Degrees

One actuator gets pressure to the head end and the other actuator gets pressure to the rod end. This causes one actuator to extend and the other to retract. This turns the nose landing gear wheels through the torsion links.

Gear Movement: 23 - 78 Degrees

When the wheels turn to 23 degrees, the swivel valve for the actuator that is pressurized to retract sends pressure to both sides of that actuator.

The actuator that was pressurized to extend continues to extend to steer the wheels. The actuator that was pressurized to retract is now pressurized to extend. Both actuators continue to extend, this lets the nose landing gear turn to the 78 degree limit.

Feedback

When the wheels get to the commanded position, the summing mechanism moves the metering valve back to neutral. This stops hydraulic pressure to the actuators. The actuators hold the wheels at the current position.

Compensator

The compensator is a spring-loaded piston type accumulator. The compensator keeps 220-290 psi pressure in the return lines of the steering system. This makes sure the steering actuators stay in their current positions when there is no input to the system.

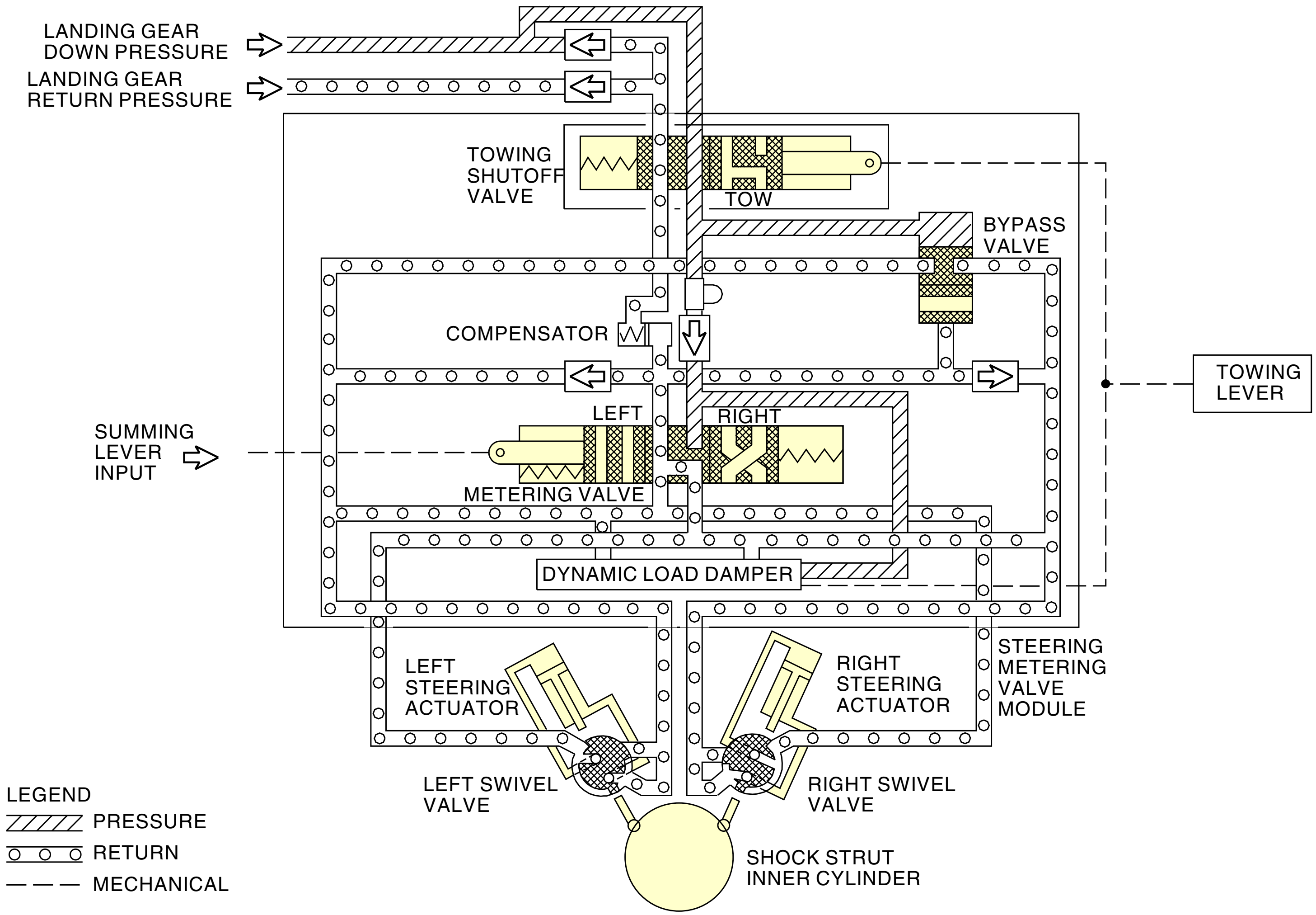
Bypass Valve

The bypass valve opens to connect both sides of the piston in the actuators when an external force turns the nose wheels. This gives protection to the internal parts of the steering system.

Dynamic Load Damper

The dynamic load damper is a hydro-mechanical, dynamic damping device that decreases shimmy in the nose steering gear. The towing lever also operates the damper to provide a fluid connection to both sides of the steering actuator pistons during an airplane tow.

NOSE WHEEL STEERING SYSTEM - FUNCTIONAL DESCRIPTION - HYDRAULIC



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NOSE WHEEL STEERING SYSTEM - FUNCTIONAL DESCRIPTION - HYDRAULIC

NOSE WHEEL STEERING SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL

General

The rotary actuator moves to the engage or disengage the rudder pedal steering mechanism from the nose wheel steering system. The landing gear transfer valve controls B system hydraulic pressure to the nose wheel steering metering valve.

Rotary Actuator

The rotary actuator moves to the engage position when the air/ground relay is energized. A nose on ground signal from the proximity switch electronics unit (PSEU) energizes the air/ground relay. The PSEU removes the nose on ground signal when the nose landing gear moves to the not compressed position. The air/ground relay moves to the air position 5 seconds after the nose on ground signal is removed. This sends power to move the rotary actuator to the disengage position.

Landing Gear Transfer Valve

When the airplane is on the ground and with normal quantity in the hydraulic system B reservoir, the landing gear transfer valve moves to the alternate position when you move the alternate nose wheel steering switch on the P2-1 panel to the ALT position.

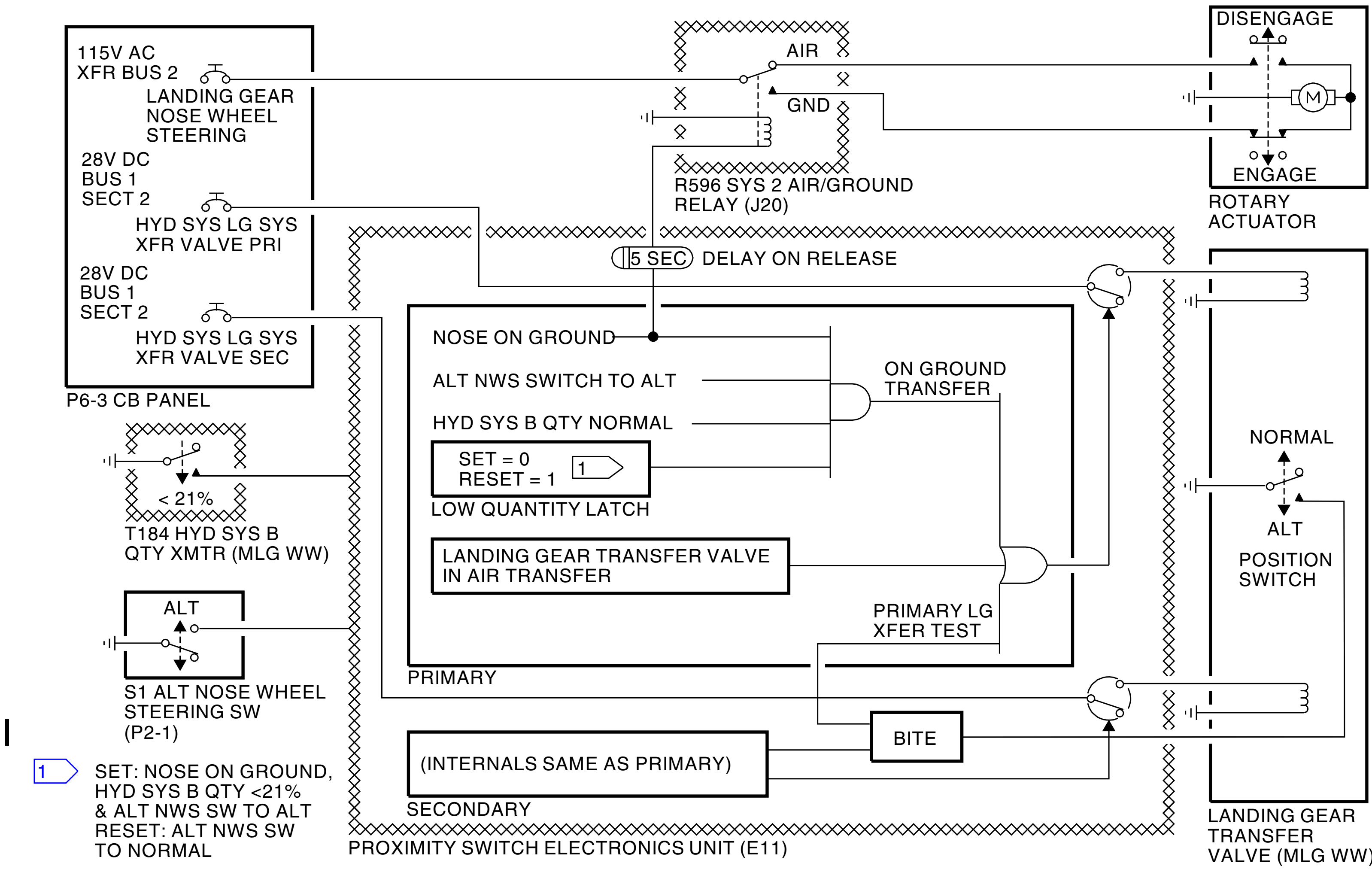
The system B low quantity latch prevents operation of the landing gear transfer valve when the alternate nose wheel steering switch is in the alternate position, and the system B hydraulic quantity momentarily decreases to less than 21 percent. The transfer valve moves to the normal position if the latch sets during alternate operation.

The low quantity latch stops intermittent operation of the transfer valve if the system B quantity increases more than and decreases less than 21 percent again and again. The latch sets when the nose air/ground system is in the ground mode and the system B quantity is low. The latch resets when the alternate nose wheel steering switch is in the normal position.

The PSEU processes the inputs and supplies two signals to the coils on the solenoid valve on the landing gear transfer valve.

The position switch on the transfer valve sends a ground to the BITE in the PSEU when the valve moves to the alternate position.

NOSE WHEEL STEERING SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL



1 SET: NOSE ON GROUND, HYD SYS B QTY <21% & ALT NWS SW TO ALT
RESET: ALT NWS SW TO NORMAL

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NOSE WHEEL STEERING SYSTEM - FUNCTIONAL DESCRIPTION - ELECTRICAL

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LG POSITION INDICATING AND WARNING SYSTEM - INTRODUCTION

Purpose

The landing gear position indicating and warning system shows landing gear position in the flight compartment. It also warns the pilots when the landing gear is not down for a landing.

Inputs

The landing gear position indicating and warning system uses these proximity sensors to supply landing gear position data to the Proximity Switch Electronic Unit (PSEU):

- Left and right main gear up and locked sensors (4)
- Left and right main gear downlock sensors (4)
- Nose gear up/down lock sensors (2)
- Nose gear down sensors (2).

The control lever position switches supply lever position.

The flight control computers supply radio altimeter data.

The stall management yaw damper computers and a switch on the trailing edge flap control unit supply the trailing edge flap position.

The horn reset switch sends a reset signal for aural warning.

The autothrottle switch packs supply thrust lever position data.

General Description

The PSEU processes all of the inputs and sends signals to the landing gear position lights and the aural warning module.

Three red landing gear position lights come on when the landing gear moves during extension and retraction and during the gear not down warning.

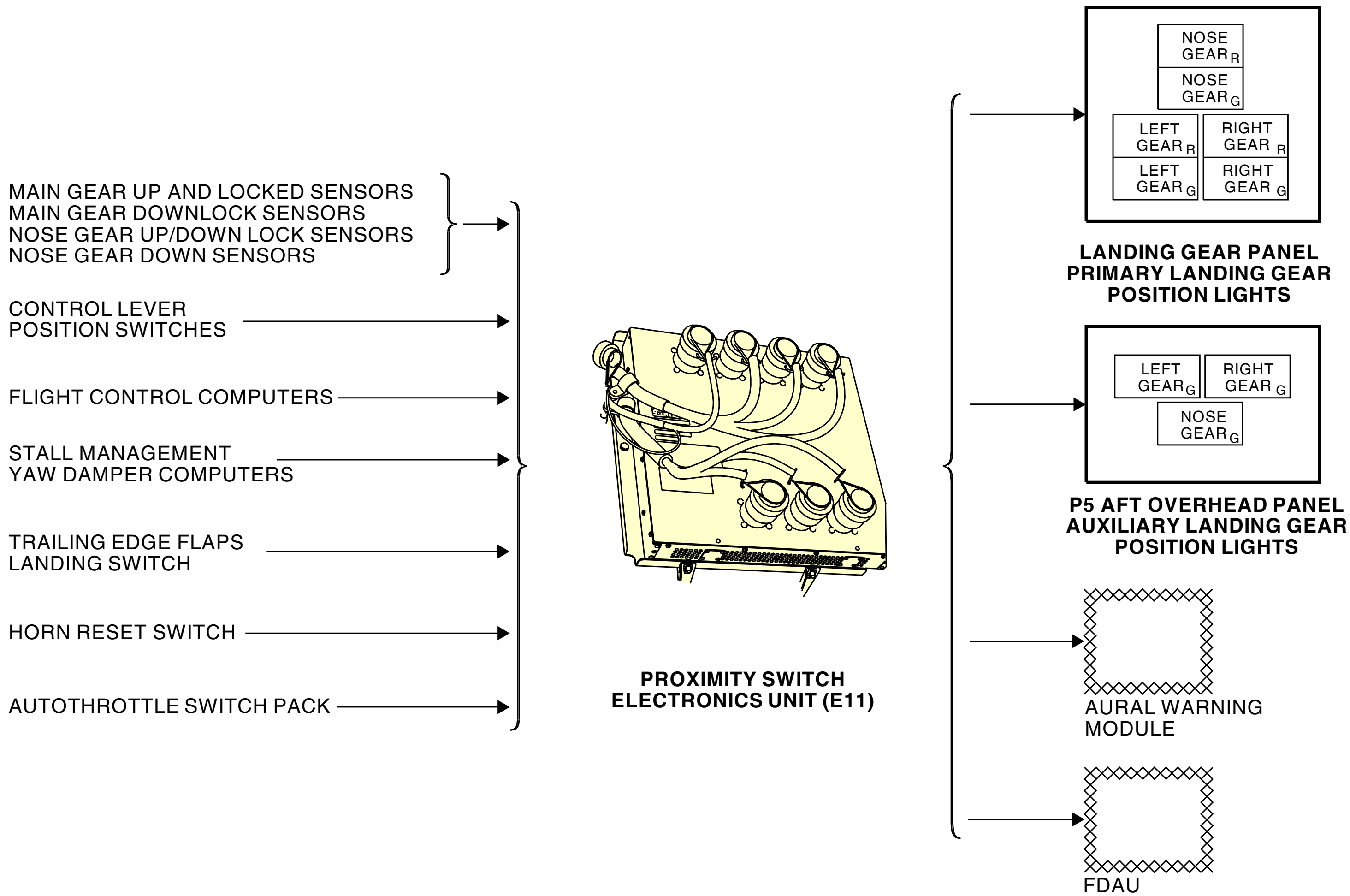
When the landing gear extends to the down and locked position, three primary and three auxiliary green landing gear position lights come on.

The PSEU also sends signals to the Flight Data Acquisition Unit (FDAU) about the status of the landing gear. See the Flight Data Recorder System (FDRS) section for more information about the FDAU. (SECTION 31-31)

Abbreviations and Acronyms

- alt - altitude
- bat - battery
- BITE - built-in test equipment
- CB - circuit breaker
- cont - control
- dc - direct current
- FCC - flight control computer
- FDAU - flight data aquisition unit
- FRDS - flight data recorder system
- fwd - forward
- LG - landing gear
- MLG - main landing gear
- NLG - nose landing gear
- PSEU - proximity switch electronics unit
- pwr - power
- SMYD - stall management yaw damper
- sw - switch
- sys - system
- TE - trailing edge

LG POSITION INDICATING AND WARNING SYSTEM - INTRODUCTION



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LG POSITION INDICATING AND WARNING SYSTEM - INTRODUCTION

LG POSITION INDICATING AND WARNING SYSTEM - POSITION LIGHTS, LEVER POSITION SWITCHES

Purpose

The position lights show the pilots the condition of the landing gear.

The landing gear switch provides a signal to the position indicating and warning system when the landing gear lever moves to the down position.

The control lever position switches provides a signal to the position indicating and warning system when the landing gear lever moves to the down position.

Location

The primary position lights are on the landing gear panel on the P2 center instrument panel, above the landing gear lever.

The auxiliary position lights are on the P5 aft overhead panel.

The control lever position switches are on the landing gear panel on the P2 center instrument panel in the flight compartment.

Functional Description

The green primary and auxiliary position lights come on when the landing gear moves to the down and locked position.

The red primary position lights come on when the position of the control lever is not the same as the position of the landing gear. The red lights also come on for the visual gear not down warning.

There is a switch actuation cam on the forward end of the control lever. The cam moves the control lever position switches to the closed position when the landing gear lever moves to the down (DN) position.

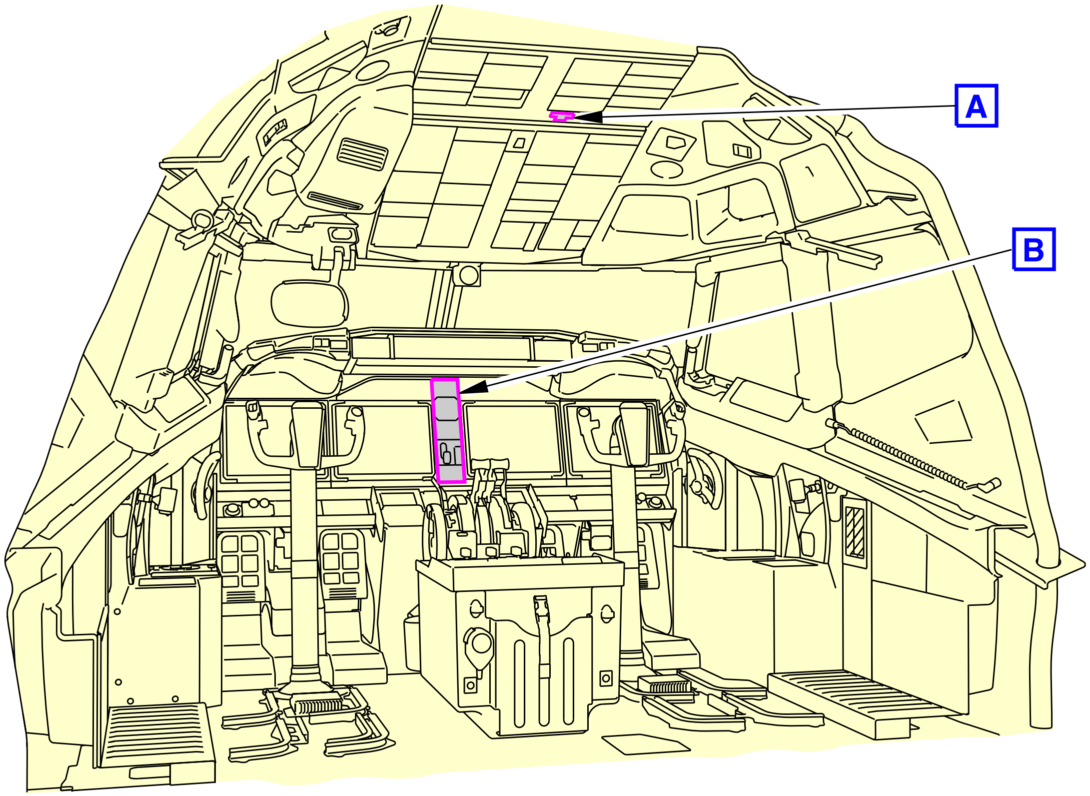
The control lever switches are in the open position when the landing gear lever is in the UP position.

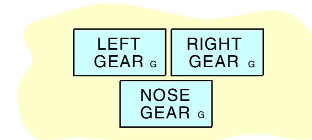
One control lever down position switch sends a landing gear control lever down position signal to the PSEU.

The other landing gear control lever down position switch provides a ground for the no smoking sign relay.

See the passenger compartment passenger signs system for more information about the no smoking sing relay (SECTION 33-25).

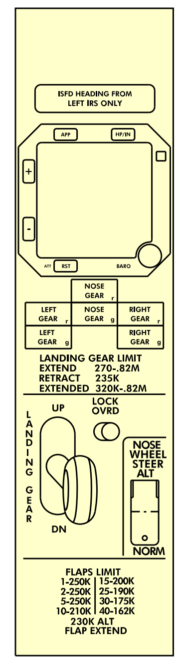
LG POSITION INDICATING AND WARNING SYSTEM - POSITION LIGHTS, LEVER POSITION SWITCHES





AUXILIARY POSITION LIGHTS (P5)

A



LANDING GEAR PANEL (P2)
(EXAMPLE)

B

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LG POSITION INDICATING AND WARNING SYSTEM - POSITION LIGHTS, LEVER POSITION SWITCHES

LG POSITION INDICATING AND WARNING SYSTEM - MAIN GEAR UP AND LOCKED SENSOR

Purpose

There are two main gear up and locked sensors on each main landing gear uplock mechanism. They send main gear up and locked information to the landing gear position indicating and warning system.

Location

The sensors are on the forward and aft sides of the MLG uplock mechanism.

The targets are also on the uplock mechanism and move with the uplock hook.

The sensor identification placards, above the sensor on the uplock mechanism frame assembly, show the sensor number. These are the MLG up and locked sensor numbers:

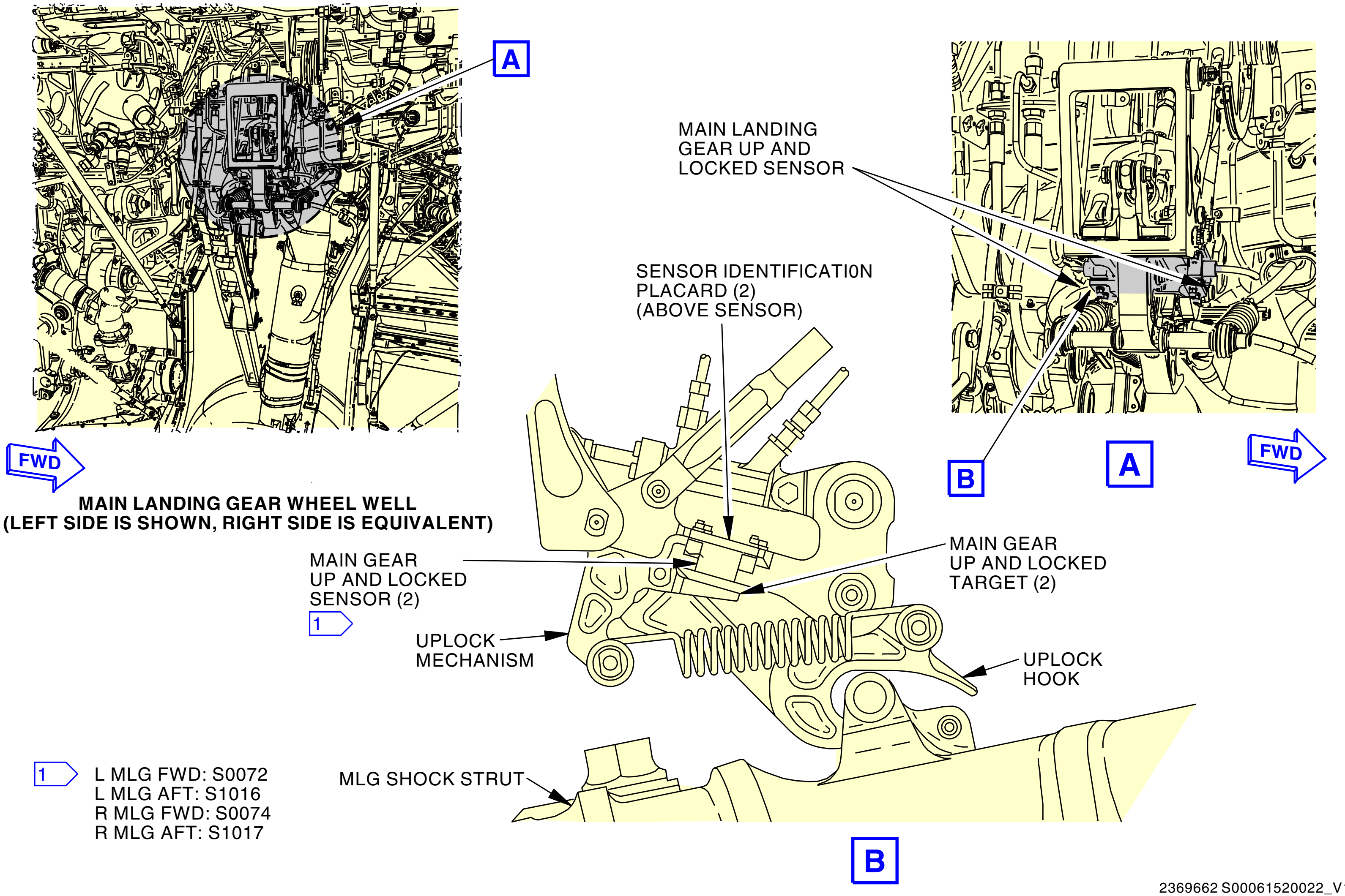
Sensor Number	MLG	Location
S0072	Left	Forward
S1016	Left	Aft
S0074	Right	Forward
S1017	Right	Aft

Functional Description

The targets are near the sensors when the uplock mechanism moves to the uplock position. This sends signals to the position indicating system in the proximity switch electronics unit (PSEU) when the main landing gear is up and locked.

The sensor wire connections are in wire splices near the uplock mechanism.

LG POSITION INDICATING AND WARNING SYSTEM - MAIN GEAR UP AND LOCKED SENSOR



LG POSITION INDICATING AND WARNING SYSTEM - MAIN GEAR UP AND LOCKED SENSOR

LG POSITION INDICATING AND WARNING SYSTEM - MAIN GEAR DOWNLOCK SENSOR

Purpose

There are two main gear downlock sensors on the downlock mechanism. The sensors supply main landing gear downlock position to the landing gear position indicating and warning system.

Location

There is one main gear downlock sensor on each side of the upper link of the downlock mechanism.

There is one target on each side of the lower link of the downlock mechanism.

The sensor identification placards on the downlock mechanism upper link show the sensor number. These are the main landing gear downlock sensor numbers:

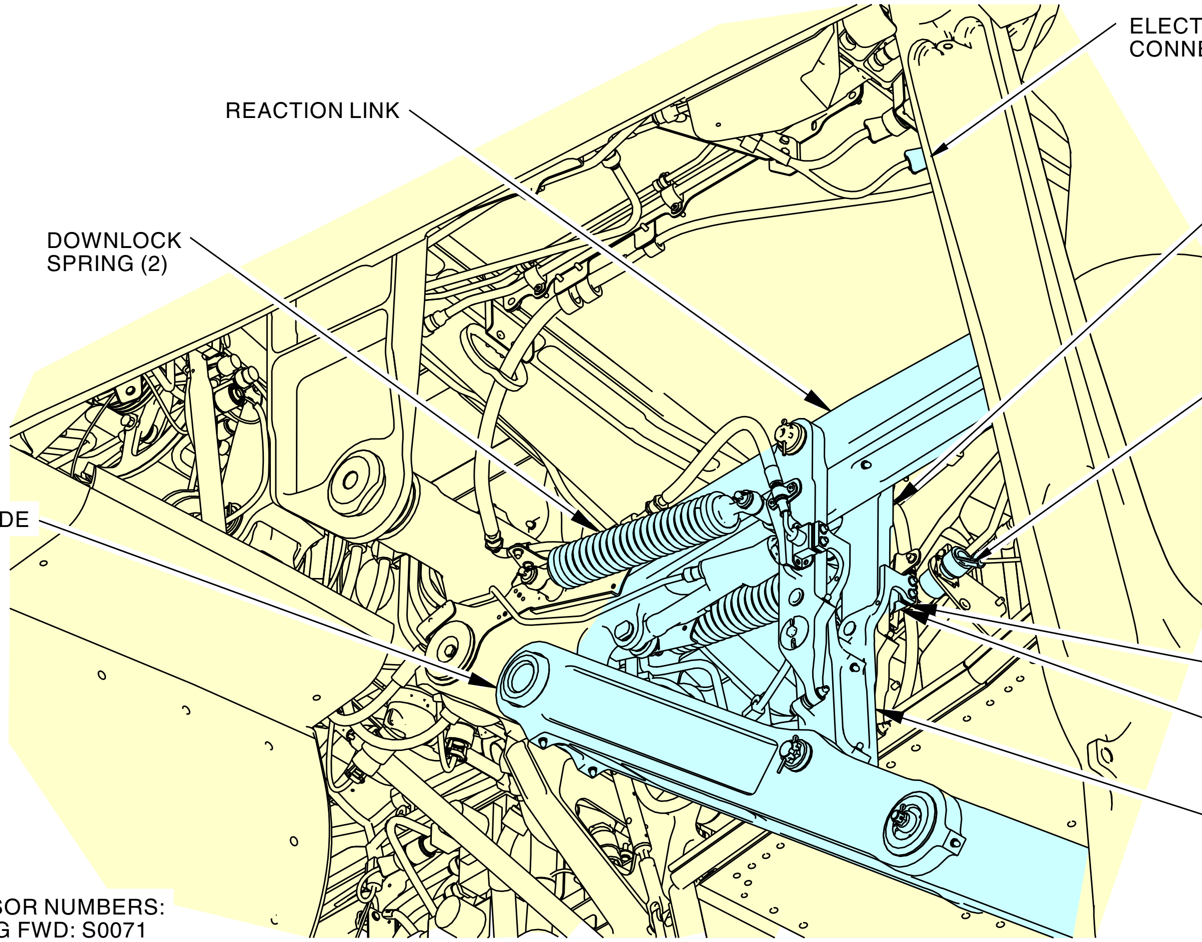
Sensor Number	MLG	Location
S0071	Left	Forward
S0073	Right	Forward
S0301	Right	Aft
S0302	Left	Aft

Functional Description

The targets move near the sensors when the downlock mechanism moves to the down and locked position. This sends signals to the landing gear position indicating and warning system in the PSEU when the main landing gear is down and locked.

The sensor wire connections are at two electrical connectors, forward and aft of the reaction link near the downlock mechanism upper link.

LG POSITION INDICATING AND WARNING SYSTEM - MAIN GEAR DOWNLOCK SENSOR



NOTE: SENSOR NUMBERS:
L MLG FWD: S0071
R MLG FWD: S0073
R MLG AFT: S0301
L MLG AFT: S0302

LEFT MAIN LANDING GEAR WHEEL WELL
(RIGHT MAIN LANDING GEAR WHEEL WELL IS EQUIVALENT)

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LG POSITION INDICATING AND WARNING SYSTEM - MAIN GEAR DOWNLOCK SENSOR

LG POSITION INDICATING AND WARNING SYSTEM - NOSE GEAR UP/DOWN LOCK SENSOR

Purpose

There are two nose gear up/down lock sensors on the lock link of the nose landing gear. They supply lock position to the landing gear position indicating and warning system.

Location

Two sensors are on the top of the aft lock link.

Two targets are on the top of the forward lock link.

The sensor identification placards, above the sensor on the uplock mechanism frame assembly, show the sensor number. These are the NLG up and locked sensor numbers:

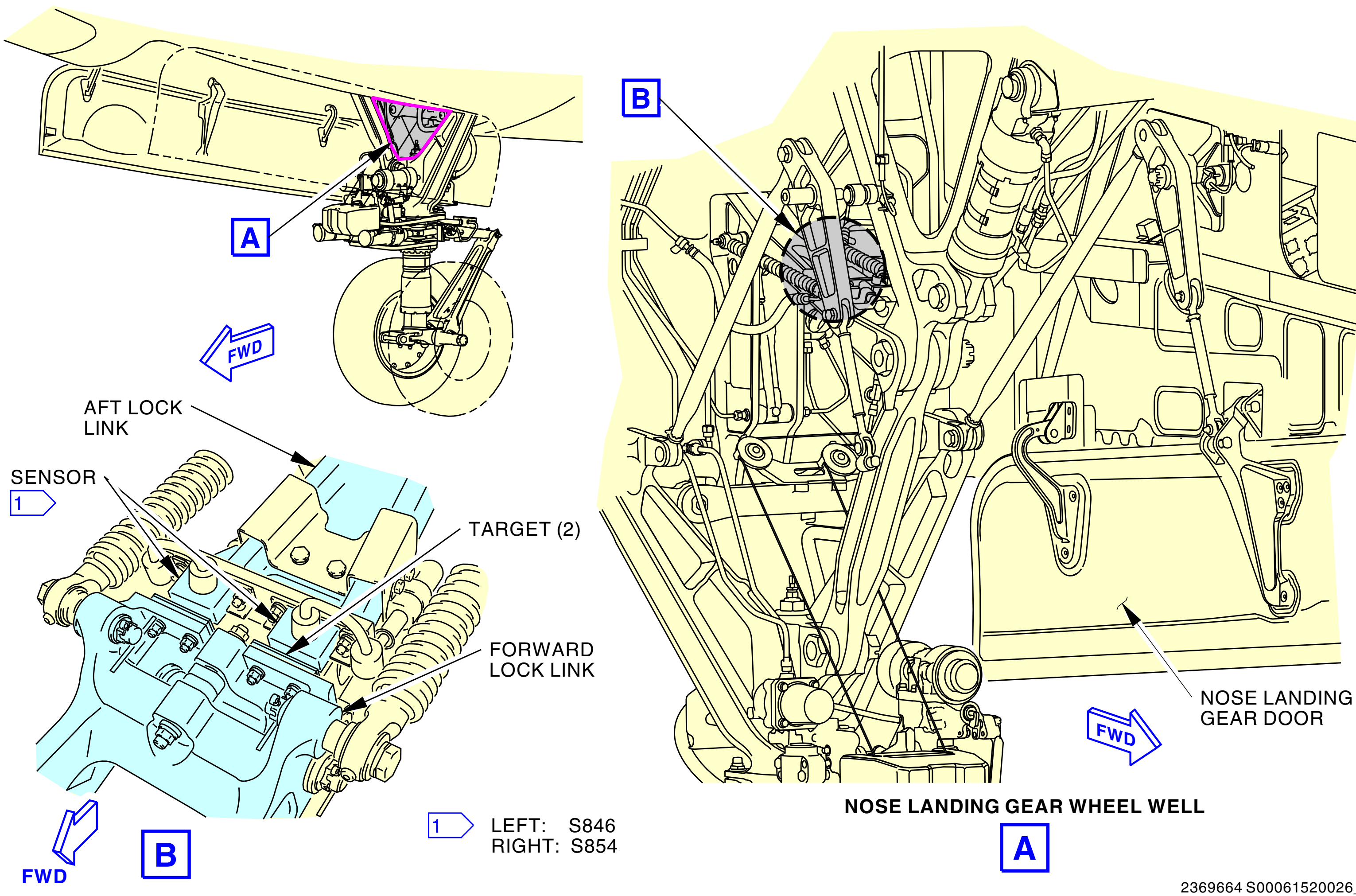
Sensor Number	Location
S0846	Left
S0854	Right

Two junctions boxes, one on each side wall aft in the nose landing gear wheel well, contain the wire connections for each of the lock sensors.

Functional Description

The targets move near the sensors when the lock link moves to the locked position. The lock link moves to the locked position when the nose landing gear is down and locked, and up and locked. This sends signals to the position indicating system in the PSEU when the nose landing gear is locked.

LG POSITION INDICATING AND WARNING SYSTEM - NOSE GEAR UP/DOWN LOCK SENSOR



LG POSITION INDICATING AND WARNING SYSTEM - NOSE GEAR UP/DOWN LOCK SENSOR

LG POSITION INDICATING AND WARNING SYSTEM - NOSE GEAR DOWN SENSOR

Purpose

There are two nose gear down sensors on the ceiling of the nose landing gear wheel well. They supply nose landing gear down position to the landing gear position indicating and warning system.

Location

Two down sensors are on the ceiling of the nose landing gear wheel well.

There is one target on each side of the top of the upper drag brace.

The sensor identification placards, on the forward side of the sensor brackets, show the sensor number. These are the NLG down sensor numbers:

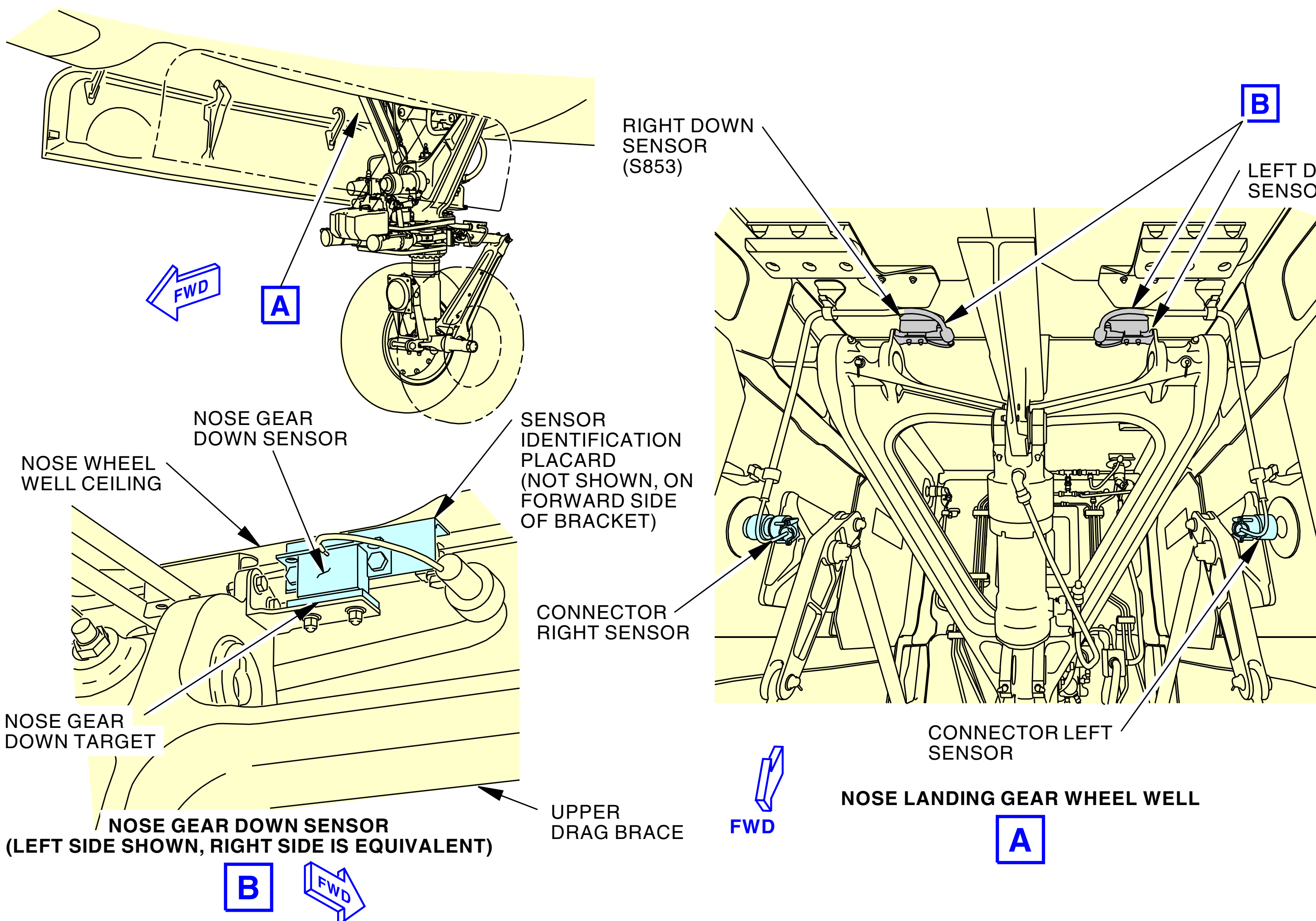
Sensor Number	Location
S0845	Left
S0853	Right

Two junction boxes, one for each sensor on the side wall in the nose landing gear wheel well, contain the sensor wire connections.

Functional Description

The targets move near the sensors when the drag brace moves to the down position. This sends signals to the position indicating system in the PSEU when the nose landing gear is in the down position.

LG POSITION INDICATING AND WARNING SYSTEM - NOSE GEAR DOWN SENSOR



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LG POSITION INDICATING AND WARNING SYSTEM - NOSE GEAR DOWN SENSOR

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LG POSITION INDICATING AND WARNING SYSTEM - FUNCTIONAL DESCRIPTION - MLG INDICATION

general

The landing gear position indicating and warning system operates lights in the flight compartment to show indications for these MLG conditions:

- Down and locked
- Lever/gear position disagree
- Gear not down warning.

Inputs

The landing gear position indicating and warning system gets inputs from eight sensors on the main landing gear. Four sensors are for the down and locked indication and four sensors are for the up and locked indication.

The control lever position switch supplies lever position data.

The autothrottle switch packs supply thrust lever position for the gear not down warning.

Both flight control computers supply a ground when the airplane altitude is less than 800 feet.

Inputs from the system 1 sensors go to system 1 in the PSEU and inputs from system 2 sensors go to system 2 in the PSEU. Both systems in the PSEU share information through a common bus.

Down And Locked Indication

The landing gear position green lights come on when targets move near the downlock sensors. System 1 operates the primary position green light. System 2 operates the auxiliary position green light.

Only system 1 sends MLG landing gear down and locked signals to the flight data acquisition unit (FDAU).

See the Flight Data Recorder System (FDRS) section for more information about the FDAU. (SECTION 31-31)

Only system 1 sends left MLG landing gear down and locked signals to the flight control computer (FCC) A.

See the Digital Flight Control System (DFCS) section for more information about the FCC. (SECTION 22-11)

Only system 1 sends left MLG landing gear down and locked signals to the stall management yaw damper (SMYD) 1.

See the Stall Warning System section for more information about the SMYD. (SECTION 27-32)

Only system 2 sends left MLG landing gear down and locked signals to the flight control computer (FCC) B.

See the Digital Flight Control System (DFCS) section for more information about the FCC. (SECTION 22-11)

Only system 2 sends left MLG landing gear down and locked signals to the stall management yaw damper (SMYD) 2.

See the Stall Warning System section for more information about the SMYD. (SECTION 27-32)

Disagree And Warning Indications

Two red landing gear position lights, one for each MLG, come on for one of these conditions:

- Control lever/landing gear position disagree: lever not down and gear not up and locked (gear retraction)
- Control lever/landing gear position disagree: lever down and gear not down and locked (gear extension)
- Gear not down warning.

The red light comes on for the gear not down warning when the landing gear is not down and locked and either of these conditions is true:

- Control lever down
- Left or right thrust lever is less than 44 degree position if the altitude is less than 800 feet.

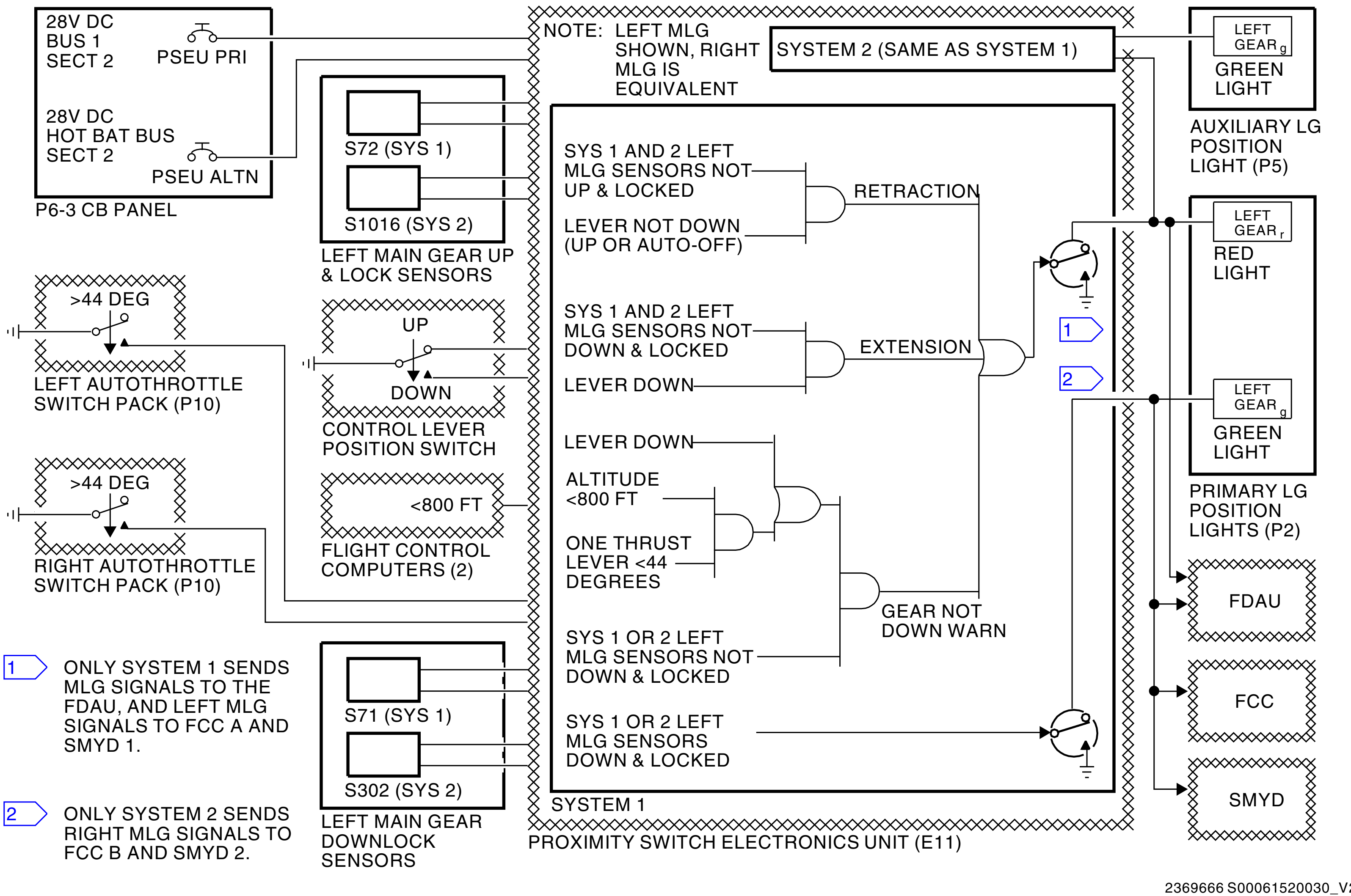
System 1 and system 2 operate the red position lights.

LG POSITION INDICATING AND WARNING SYSTEM - FUNCTIONAL DESCRIPTION - MLG INDICATION

Only system 1 sends landing gear down and lock or landing gear disagree and warning signals to the flight data acquisition unit (FDAU).

See the Flight Data Recorder System (FDRS) section for more information about the FDAU. (SECTION 31-31)

LG POSITION INDICATING AND WARNING SYSTEM - FUNCTIONAL DESCRIPTION - MLG INDICATION



LG POSITION INDICATING AND WARNING SYSTEM - FUNCTIONAL DESCRIPTION - MLG INDICATION

LG POSITION INDICATING AND WARNING SYSTEM - FUNCTIONAL DESCRIPTION - NLG INDICATION

General

The landing gear position indicating and warning system operates lights in the flight compartment to show indications for these NLG conditions:

- Down and locked
- Lever/gear position disagree
- Gear not down warning.

Inputs

The landing gear position indicating and warning system gets inputs from four sensors on the nose landing gear. Two sensors are for the down indication and two sensors are for the locked indication.

The control lever position switch supplies lever position data.

The autothrottle switch packs supply thrust lever position for the gear not down warning.

Both flight control computers supply a ground when the airplane altitude is less than 800 feet.

Inputs from the system 1 sensors go to system 1 in the PSEU. Inputs from system 2 sensors go to system 2 in the PSEU. Both systems in the PSEU share information through the same bus.

Down And Locked Indication

The landing gear position green lights come on when targets move near the down sensors and near the lock sensors. System 1 operates the primary position green light. System 2 operates the auxiliary position green light.

Only system 1 sends NLG landing gear down and locked signals to the flight data acquisition unit (FDAU).

See the Flight Data Recorder System (FDRS) section for more information about the FDAU. (SECTION 31-31)

Disagree And Warning Indications

A red landing gear position light comes on for these conditions:

- Control lever/landing gear position disagree - lever not down and gear not up and locked (gear retraction)
- Control lever/landing gear position disagree - lever down and gear not down and locked (gear extension)
- Gear not down warning.

The red light comes on for the gear not down warning when the nose landing gear is not down and locked and either of these conditions is true:

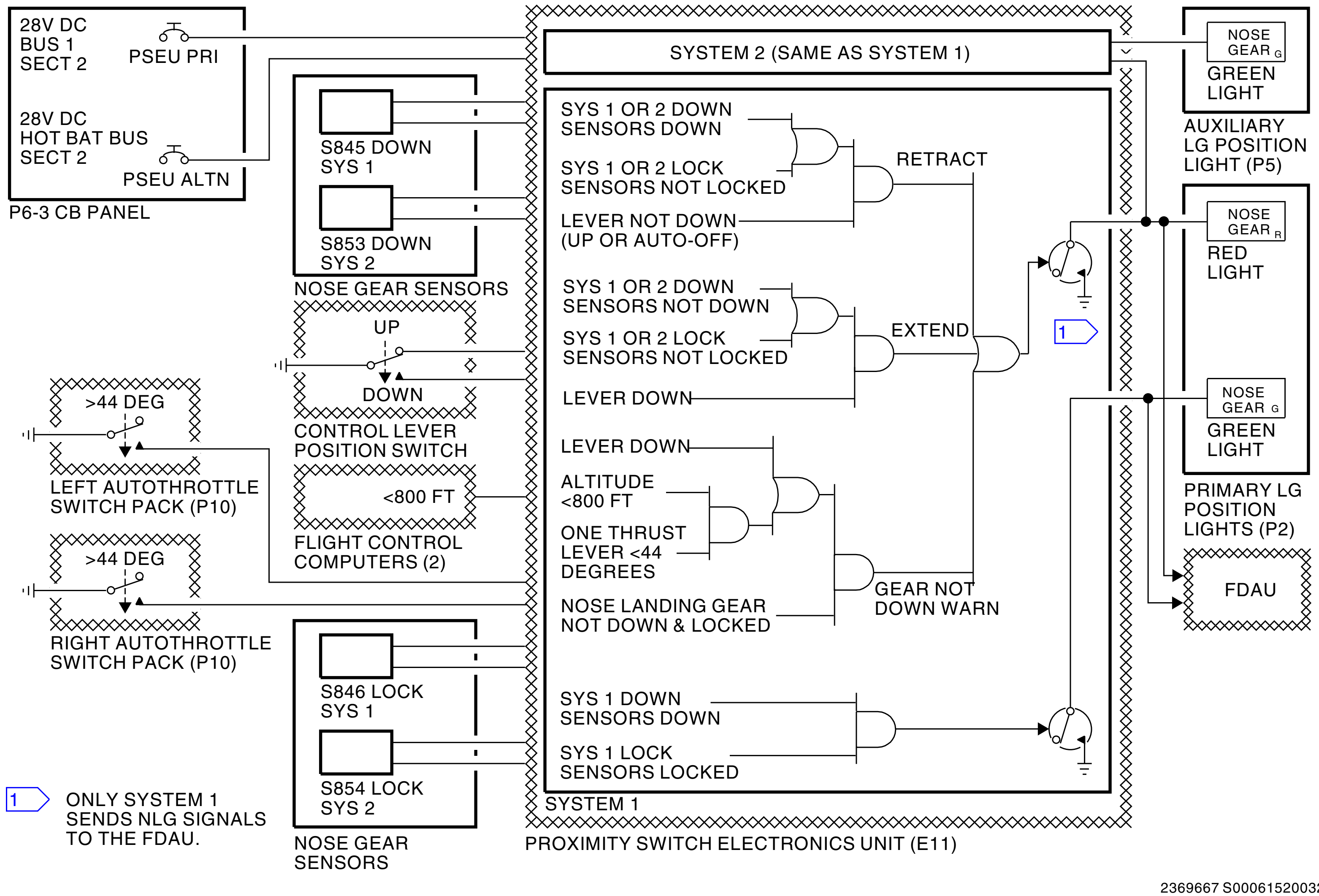
- Control lever down
- Left or right thrust lever less than 44 degree position if the altitude is less than 800 feet.

System 1 and system 2 operate the red position light.

Only system 1 sends NLG landing gear disagree and warning signals to the flight data acquisition unit (FDAU).

See the Flight Data Recorder System (FDRS) section for more information about the FDAU. (SECTION 31-31)

LG POSITION INDICATING AND WARNING SYSTEM - FUNCTIONAL DESCRIPTION - NLG INDICATION



LG POSITION INDICATING AND WARNING SYSTEM - FUNCTIONAL DESCRIPTION - NLG INDICATION

LG POSITION INDICATING AND WARNING SYSTEM - AURAL WARNING - GENERAL DESCRIPTION

General

The aural warning module gives the continuous horn sound for a landing warning.

There are four sets of conditions which cause the landing warning.

In the first set of conditions, the horn sounds when these conditions are true:

- Gear is not down and locked
- Flap position is from 0 to 10 units
- Thrust levers are set for landing
- Radio altitude is between 200 and 800 feet.

For the first set of conditions, push the horn cutout switch near the flap lever to stop the horn.

In the second set of conditions, the horn sounds when these conditions are true:

- Gear is not down and locked
- Flap position is from 0 to 10 units
- Thrust levers are set for landing
- Radio altitude is less than 200 feet.

For the second set of conditions, the pilot can not stop the horn.

In the third set of conditions, the horn sounds when these conditions are true:

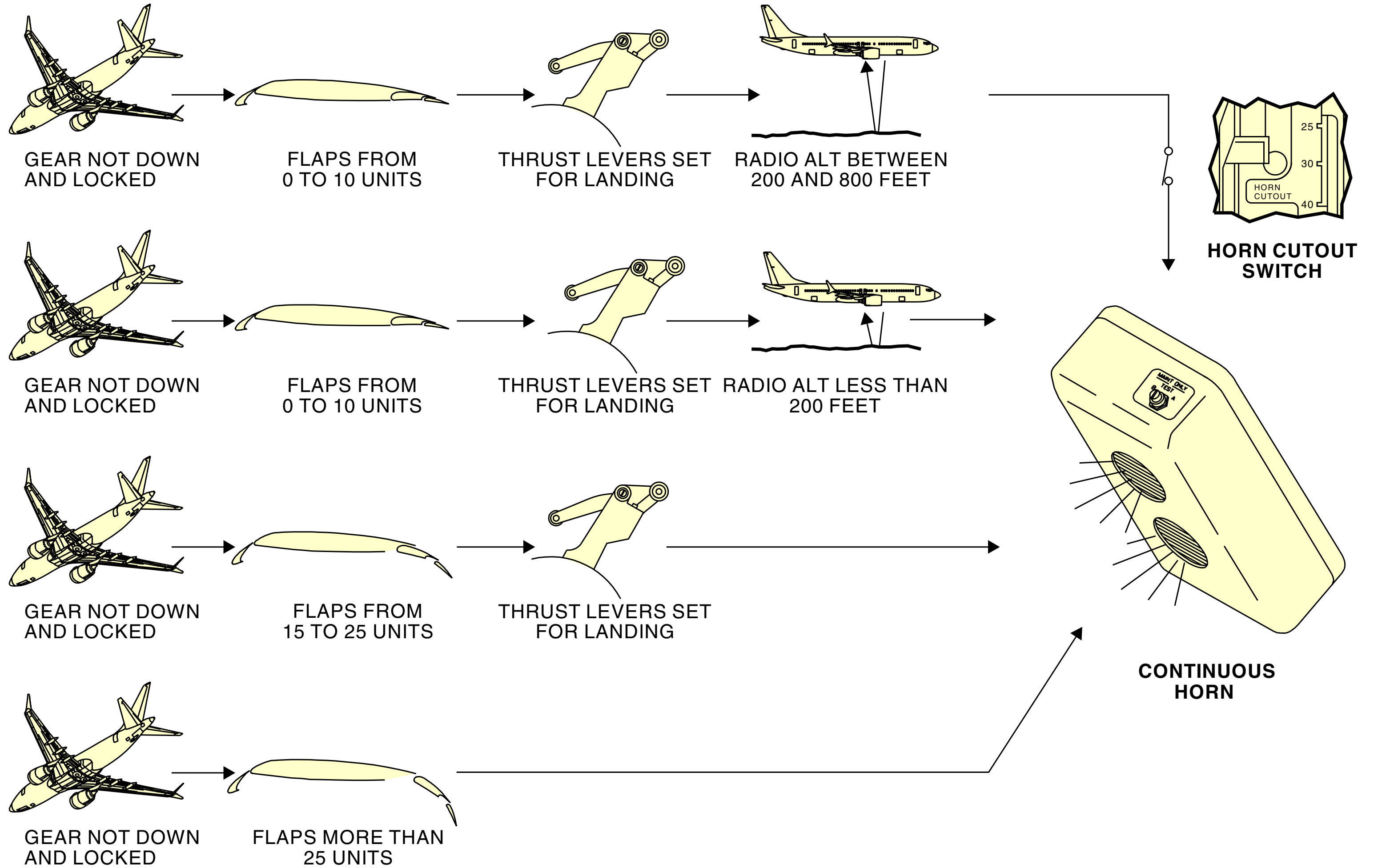
- Gear is not down and locked
- Flap position is from 15 to 25 units
- Thrust levers are set for landing.

For this set of conditions, the pilot can not stop the horn.

In the fourth set of conditions, the horn sounds when the gear is not down and locked and the flap position is more than 25 units. The pilot can not stop the horn.

When the airplane is in the fourth set of conditions, the system inhibits the landing warning horn during a go-around. The system inhibits the warning for 12 seconds after the pilot puts the gear lever in the up position.

LG POSITION INDICATING AND WARNING SYSTEM - AURAL WARNING - GENERAL DESCRIPTION



LG POSITION INDICATING AND WARNING SYSTEM - AURAL WARNING - GENERAL DESCRIPTION

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LG POSITION INDICATING AND WARNING SYSTEM - AURAL WARNING - FUNCTIONAL DESCRIPTION

General

The landing gear position indicating and warning system uses the aural warning system to give a landing gear not down aural warning to the pilots.

Inputs

The landing gear position sensors send landing gear down and lock position data to the PSEU.

The landing gear control lever position switch sends a down position signal to the PSEU.

Both stall management yaw dampers (SMYDs) supply signals when the trailing edge flaps are less than 1 unit or more than 25 units. This signal gives the trailing edge flaps takeoff position to the PSEU.

The trailing edge flap landing warning switch on the trailing edge flap control unit supplies a signal when the trailing edge flaps are more than 10 units. This signal gives the trailing edge flaps landing position to the PSEU.

Both flight control computers (FCCs) supply signals when the airplane altitude is less than 200 feet and less than 800 feet.

The engine running relays send left and right engine running signals to the PSEU.

The autothrottle switch packs supply signals when the thrust levers are at the idle position.

The horn reset switch lets you stop the aural warning during some of the conditions that cause a landing gear not down aural warning.

Aural Warning

The PSEU sends a landing gear not down aural warning signal to the aural warning module. This causes the steady horn to sound.

The aural warning has two types of warnings, one that you can not stop by the horn reset switch and one that you can stop by the horn reset switch.

The aural warning does not operate for 20 seconds if the landing gear control lever is in the down position.

The aural warning operation is different for each of these trailing edge (TE) flap conditions:

- 0 through 10 units
- 15 through 25 units
- More than 25 units.

TE Flap Position 0 Through 10 Units, Condition 1

This type of aural warning operates when one or more landing gear is not in the down and locked position, the landing gear control lever is not down, and all of these conditions are true:

- TE Flap landing warning switch A & B <10 units
- One or both thrust levers at idle or one or both engines not running
- Altitude between 800 and 200 feet.

The horn can be stopped with the horn reset switch for the above conditions.

TE Flap Position 0 Through 10 Units, Condition 2

This type of aural warning operates when one or more landing gear is not in the down and locked position, the landing gear control lever is not down, and all of these conditions are true:

- TE Flap landing warning switch A & B <10 units
- One or both thrust levers at idle or one or both engines not running
- Altitude less than 200 feet.

The horn can not be stopped with the horn reset switch when the trailing edge flaps are in the 0 through 10 unit position, and the airplane altitude is less than 200 feet.

LG POSITION INDICATING AND WARNING SYSTEM - AURAL WARNING - FUNCTIONAL DESCRIPTION

TE Flap Position 15 Through 25 Units

This type of aural warning operates when one or more landing gear is not in the down and locked position, the landing gear control lever is not down, and all of these conditions are true:

- TE Flaps landing warning switch A and B >10 units
- One or both SMYDs TE Flaps 15 through 25 units
- One or both thrust levers at idle or one or both engines not running.

The horn can not be stopped with the horn reset switch when the trailing edge flaps are in the 15 through 25 unit position.

TE Flap Position More Than 25 Units

This type of aural warning operates when one or more landing gear is not in the down and locked position and all of these conditions are true:

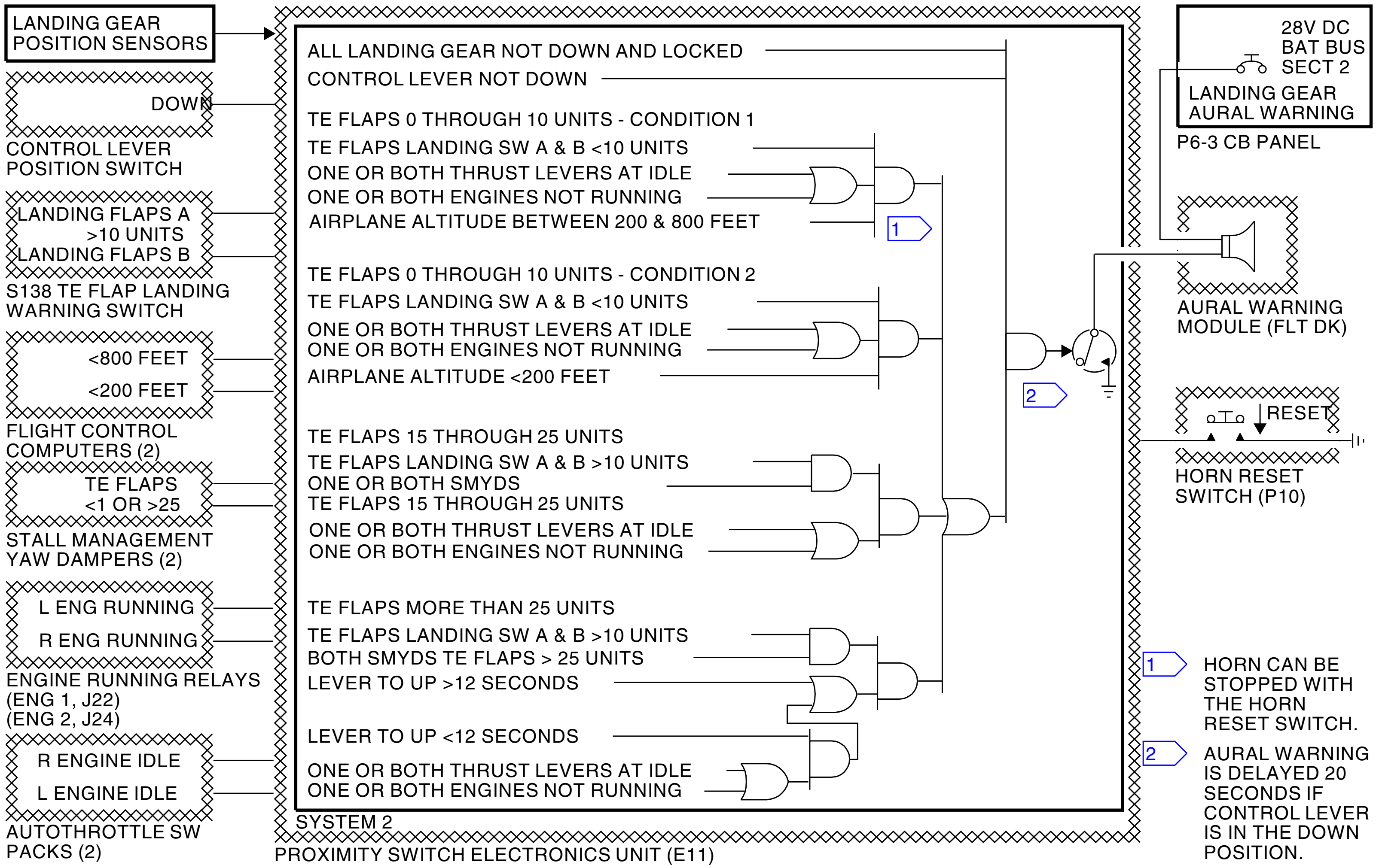
- TE Flaps landing warning switch A and B >10 units
- Both SMYDs TE Flaps > 25 units.

Also, one of these two conditions must be true:

- Landing gear control lever is in the UP position for more than 12 seconds
- Landing gear control lever is in the UP position for less than 12 seconds and one or both thrust levers at idle or one or both engines not running.

The horn can not be stopped with the horn reset switch when the trailing edge flaps are more than 25 units.

LG POSITION INDICATING AND WARNING SYSTEM - AURAL WARNING - FUNCTIONAL DESCRIPTION



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LG POSITION INDICATING AND WARNING SYSTEM - AURAL WARNING - FUNCTIONAL DESCRIPTION

LG POSITION INDICATING AND WARNING SYSTEM - ENGINE THROTTLE SWITCHES

Purpose

The engine throttle switches supply data to the proximity switch electronics unit (PSEU) for the landing gear position indicating and warning function. The PSEU uses this data to enable or disable landing gear warning, takeoff warning, and horn cutout.

Location

The engine throttle switches are on the autothrottle switchpacks below the control stand. To get access, go through access panels in the overhead of the nose landing gear wheel well.

Physical Description

The engine throttle switches operate when the thrust levers move to more than the idle position, more than 44 degrees of thrust resolver angle (TRA) movement.

Functional Description

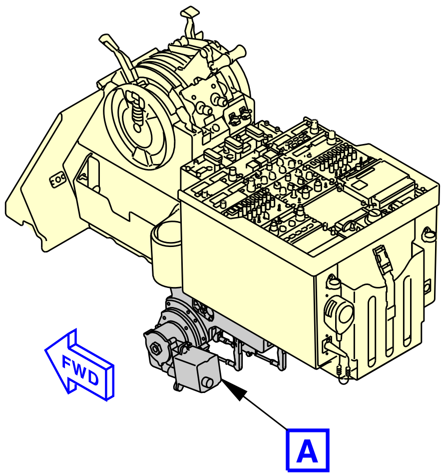
This table gives you information about the landing gear warning and takeoff warning switches.

Name	Switch	TRA Position
Landing Gear Warning	S1	RET < 44 landing approach logic enabled
Aural Warning - Takeoff Warning	S8	ADV > 53 takeoff warning enabled, landing approach logic enabled, horn cutout enabled, operates tail skid (option)
Landing Gear Warning	S9	ADV > 64 landing approach logic enabled, horn cutout disabled

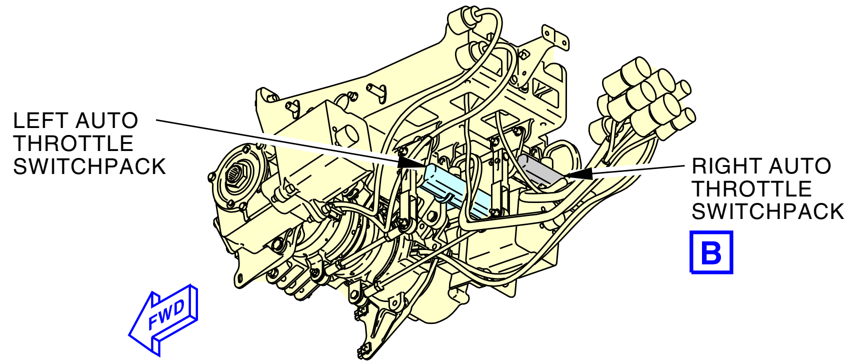
Training Information Point

You can remove the switches as the switchpack assembly.

LG POSITION INDICATING AND WARNING SYSTEM - ENGINE THROTTLE SWITCHES

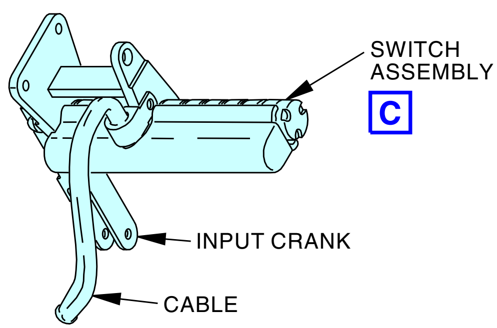


CONTROL STAND



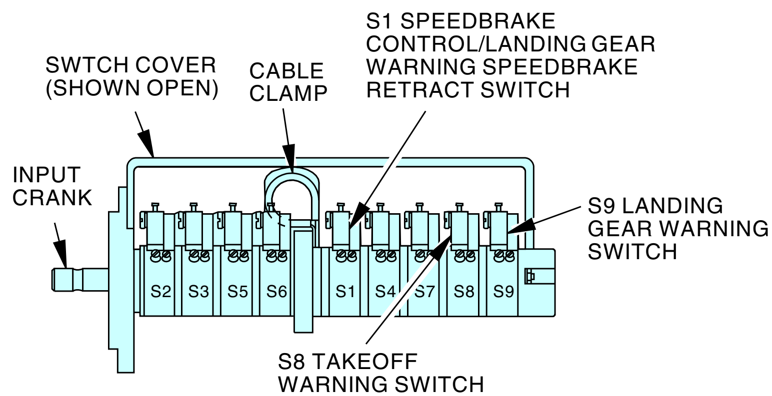
VIEW FROM NOSE LANDING GEAR WHEEL WELL (LOOKING FORWARD)

A



RIGHT AUTOTHROTTLE SWITCHPACK

B



SWITCH ASSEMBLY

C

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LG POSITION INDICATING AND WARNING SYSTEM - ENGINE THROTTLE SWITCHES

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TAIL SKID - GENERAL DESCRIPTION

Purpose

The tail skid protects the stabilizer bulkhead and fuselage structure when the main landing gear shock struts are extended and the airplane rotates during takeoff.

General Description

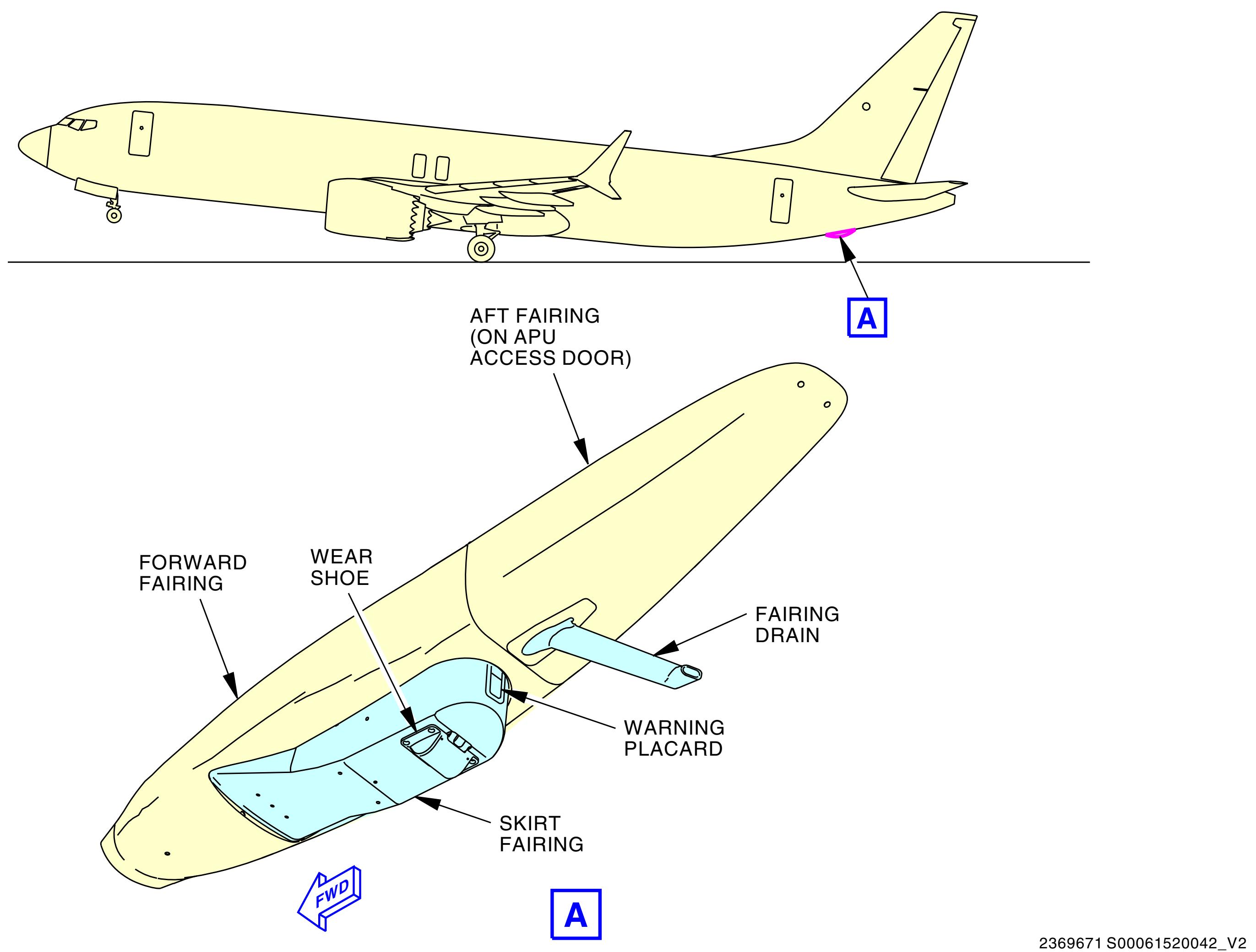
SIA ALL; AIRPLANES WITH FIXED POSITION TAIL SKID

The tail skid is on the bottom exterior surface of the airplane below the horizontal stabilizer. The tail skid has a wear shoe. The wear shoe absorbs the tail strike when the shoe rubs on the runway. A warning placard on the aft surface of the skirt fairing shows when you should replace the tail skid.

The forward fairing supplies an aerodynamic cover around the tail skid skirt fairing. The forward fairing attaches to the bottom skin of the airplane. The aft fairing continues the aerodynamic cover aft of the skirt fairing. The aft fairing attaches to the APU access door. A drain on the aft fairing drains moisture from the inside the fairing.

SIA ALL

TAIL SKID - GENERAL DESCRIPTION



TAIL SKID - GENERAL DESCRIPTION

TAIL SKID - COMPONENT LOCATION

General

The drag lever extends below the bottom of the fuselage during landing. If over-rotation occurs, the wear shoe on the drag lever may touch the runway. If this occurs, the drag lever transmits the rotational energy to the cartridge assembly. The cartridge assembly absorbs the energy.

Component Location

The tail skid has these components:

SIA ALL; AIRPLANES WITH FIXED POSITION TAIL SKID

- Upper rod
- Fuse link
- Pivot linkage link
- Frangible cartridge
- Lower rod
- Wear shoe
- Skirt fairing
- Drag link
- Lanyard

SIA ALL

The wear shoe and skirt fairing are on the outside lower surface of the tail of the airplane. All other tail skid components are in the lower area of the stabilizer compartment.

Location

The cartridge assembly, drag lever, and wear shoe are on the airplane centerline at the bottom of section 48 forward of the auxiliary power unit (APU) access doors.

Physical Description

The cartridge assembly attaches to the drag lever at one end. It attaches to structure at the other end by the upper attach link.

The cartridge assembly includes these components:

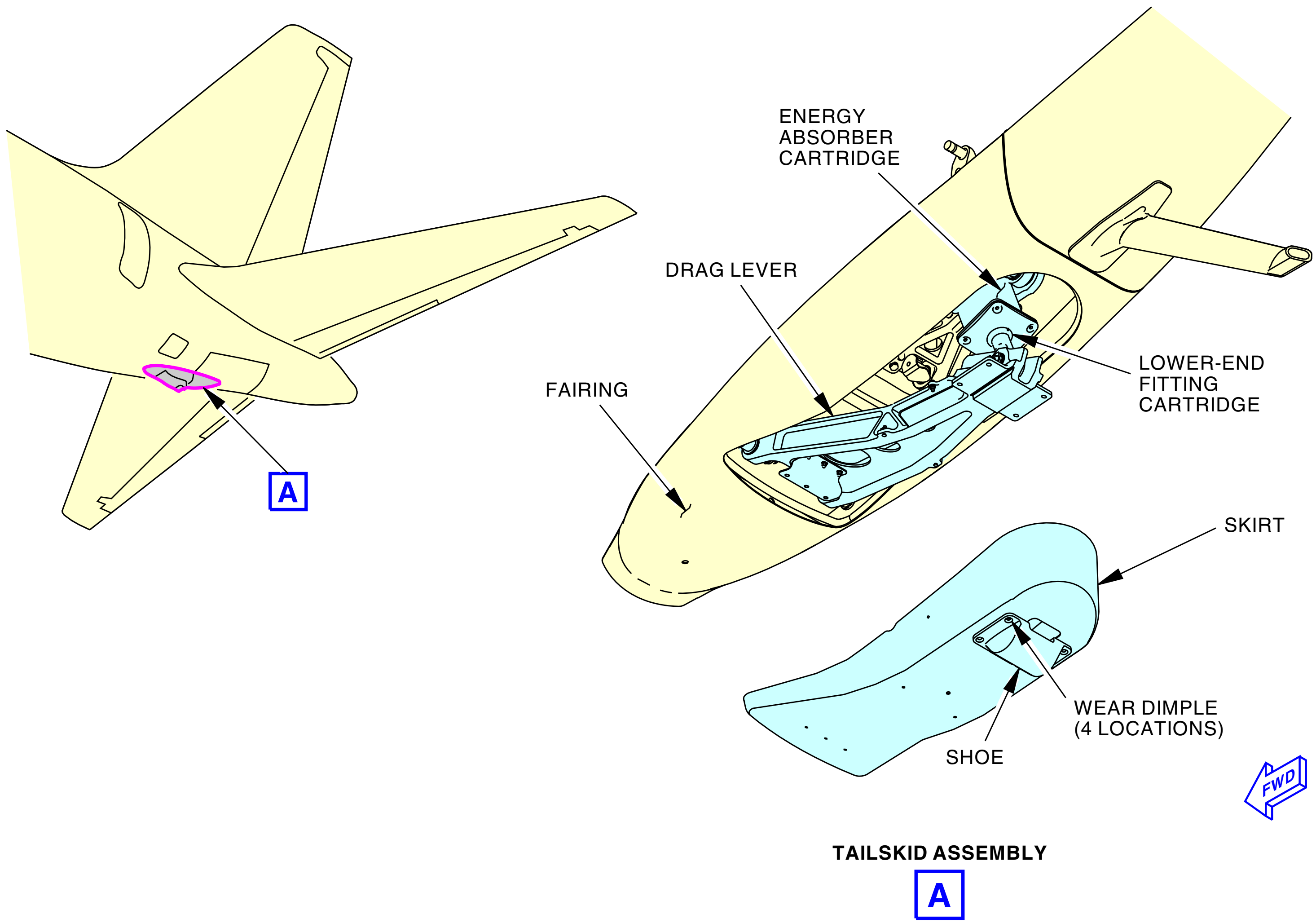
- Male telescoping rod assembly
- Female telescoping rod assembly
- Crushable cartridge core assembly

The crushable cartridge core assembly is an aluminum honeycomb cylinder with a hollow center core.

The male and female telescoping rod assemblies attach to the crushable cartridge. The male and female telescoping rod halves slide together freely in the hollow center core of the cartridge assembly.

The wear shoe is a painted metal part. It attaches to the end of the drag lever. It is the part that touches the runway if the airplane over-rotates during takeoff or landing.

TAIL SKID - COMPONENT LOCATION



TAIL SKID - COMPONENT LOCATION

TAIL SKID - FUNCTIONAL DESCRIPTION

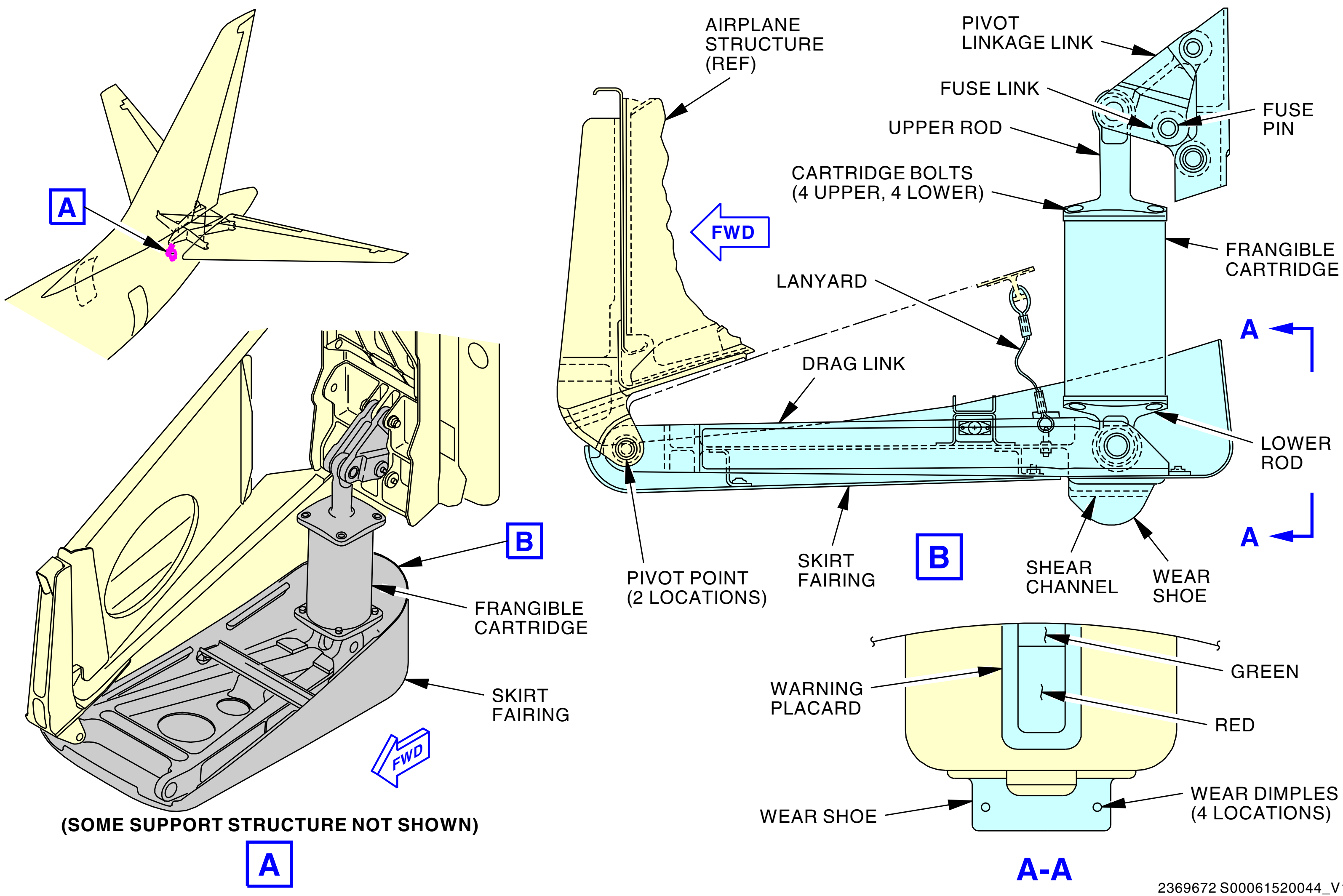
Functional Description

When a tail strike occurs that has a small force, the wear shoe rubs on the runway to absorb the force of the tail strike. Four wear dimples on the lower surface of the shoe, two forward and two aft, show when you must replace the wear shoe. You replace the wear shoe when the material of the shoe wears to the level of the wear dimples. If the wear shoe hits an object while it rubs on the runway, the lower part of the wear shoe shears off. The lower part of the wear shoe shears at the shear channel. This prevents damage to the tail skid components.

When a tail strike occurs that has a large force, the frangible cartridge crushes to absorb the force of the tail strike. The wear shoe attaches to a drag link which pivots on airplane structure. The warning placard on the aft surface of the skirt fairing shows how much the cartridge has been crushed. The lower part of the placard is red, the upper part is green. Usually you can see both parts of the placard. If you can not see the green part of the placard, the cartridge has been crushed to its limit. You must now replace the cartridge. The lanyard holds the drag link when you replace the cartridge.

If the tail strike has very large force, the force shears the fuse pin. The fuse pin prevents damage to the airplane structure. The fuse pin attaches the fuse link to the pivot linkage link. As the tail skid drag link rotates up with the force, the pivot link rotates up on its pivot on airplane structure.

TAIL SKID - FUNCTIONAL DESCRIPTION



FIXED POSITION TAIL SKID - FUNCTIONAL DESCRIPTION